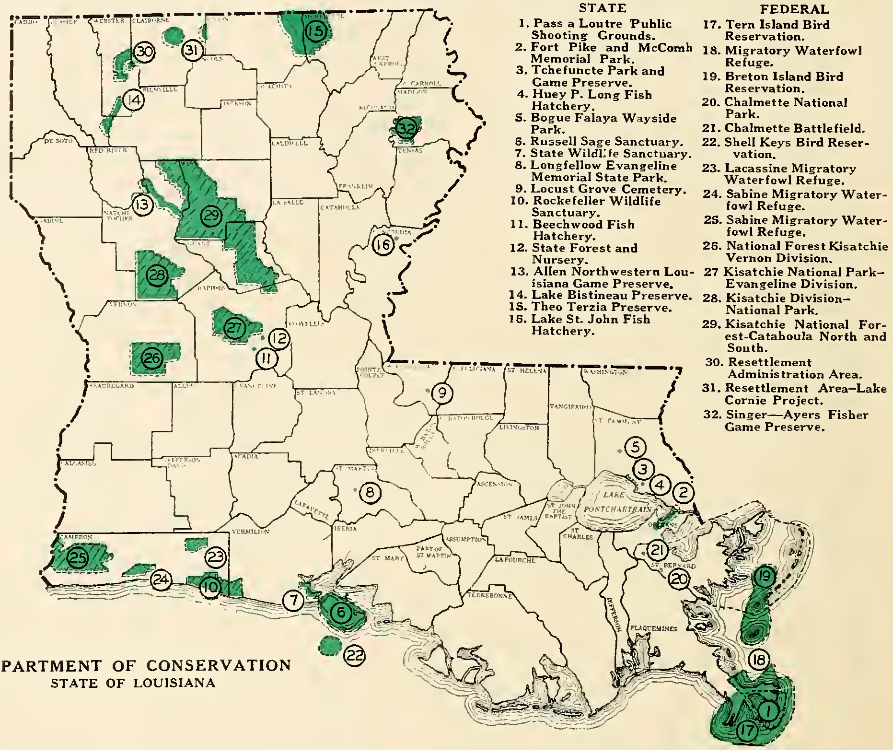
Shelf

Louisiana CONSERVATION REVIEW

Published Quarterly

Spring 1938

Louisiana State and National Parks, Fish and Game Preserves, Wildlife Refuges



STATE

1. Pass a Loutre Public Shooting Grounds.
2. Fort Pike and McComb Memorial Park.
3. Tchefuncte Park and Game Preserve.
4. Huey P. Long Fish Hatchery.
5. Bogue Falaya Wayside Park.
6. Russell Sage Sanctuary.
7. State Wildlife Sanctuary.
8. Longfellow Evangeline Memorial State Park.
9. Locust Grove Cemetery.
10. Rockefeller Wildlife Sanctuary.
11. Beechwood Fish Hatchery.
12. State Forest and Nursery.
13. Allen Northwestern Louisiana Game Preserve.
14. Lake Bistineau Preserve.
15. Theo Terzia Preserve.
16. Lake St. John Fish Hatchery.

FEDERAL

17. Tern Island Bird Reservation.
18. Migratory Waterfowl Refuge.
19. Breton Island Bird Reservation.
20. Chalmette National Park.
21. Chalmette Battlefield.
22. Shell Keys Bird Reservation.
23. Lacassine Migratory Waterfowl Refuge.
24. Sabine Migratory Waterfowl Refuge.
25. Sabine Migratory Waterfowl Refuge.
26. National Forest Kisatchie Vernon Division.
27. Kisatchie National Park–Evangeline Division.
28. Kisatchie Division–National Park.
29. Kisatchie National Forest-Catahoula North and South.
30. Resettlement Administration Area.
31. Resettlement Area–Lake Cornie Project.
32. Singer—Ayers Fisher Game Preserve.

DEPARTMENT OF CONSERVATION
STATE OF LOUISIANA

Louisiana, Pioneer Conservationist

The map reproduced above shows the location of Louisiana's parks, game preserves and wildlife refuges.

Louisiana was a pioneer in the protection of its wildlife and has been continually stepping ahead in this important phase of conservation.

To-day there are approximately three-quarters of a million acres dedicated as recreation areas and wildlife sanctuaries in the State of Louisiana, besides millions of acres that enjoy a de facto state of protection through the co-operation of land-owners with the Department of Conservation.

The latest addition to these areas, Tchefuncte Park and Game Preserve, was purchased for about $10 an acre; but it would hardly be possible to estimate the value of these lands to the State. Oil royalties and other sources of commercial revenue will create a vast new source of wealth, but their true value will be measured in the opportunities which they offer for the enjoyment of healthy outdoor life.

DEPARTMENT OF CONSERVATION
126 Civil Courts Building
New Orleans, La.

CONTE

of this issue for Spring, 1938

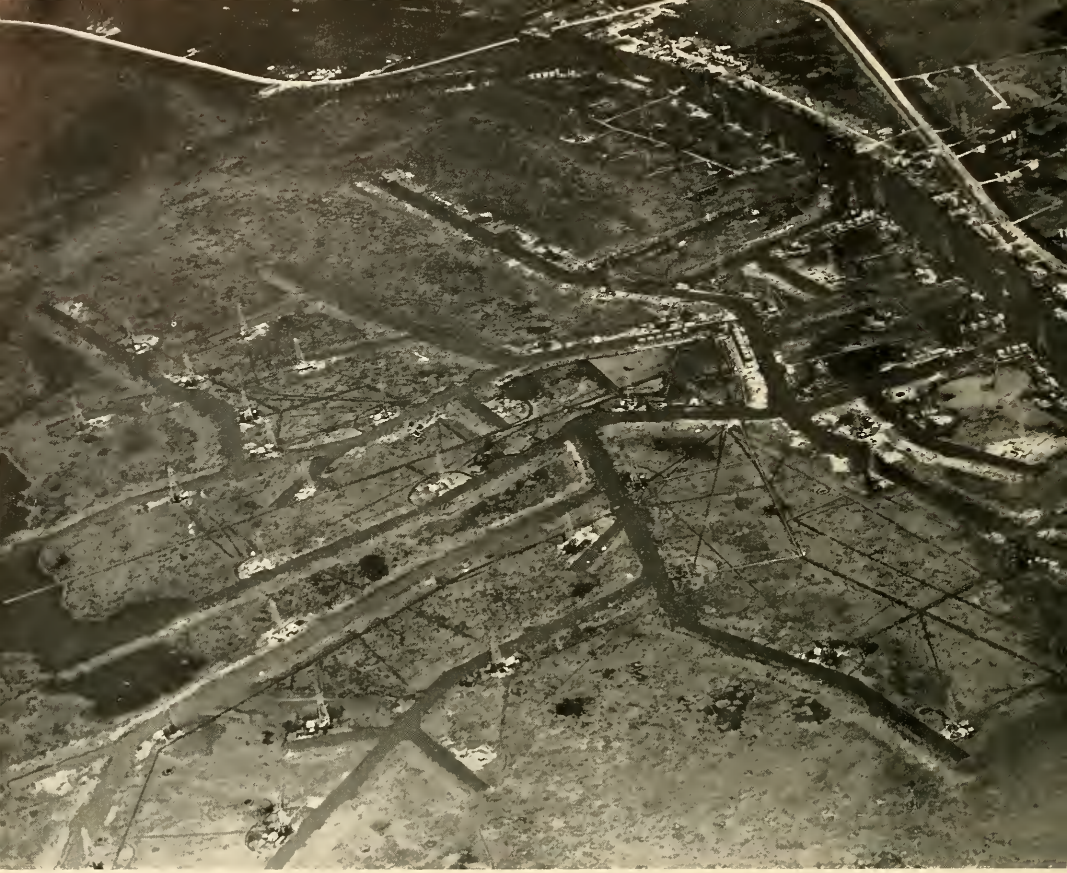
Page

SIGNIFICANT ASPECTS OF LOUISIANA'S OIL DEVELOPMENT 5
By William G. Rankin
YES, LOUISIANA IS GETTING HOT, MR. JONES! 7
(Advertisement of the Department of Conservation in the Tulsa (Okla.) Tribune)
WHEN THE WELL BLOWS OUT 11
ELECTRICAL EXPLORATION OF DRILL HOLES 12
(Schlumberger Process)
GEOLOGICAL SURVEY 16
THE BIOLOGIST AND CONSERVATION 17
By Percy Viosca, Jr.
PROSPECT OF PULP AND PAPER INDUSTRIES 18
THE BIRTH OF LOUISIANA'S STATE FLOWER 19
WORLD'S LARGEST SHRIMP CANNERY 21
THE CO-OPERATIVE SHRIMP INVESTIGATIONS 24
TCHEFUNCTE STATE PARK AND CONSERVATION RESERVATION 27
CLAYS IN LOUISIANA 31
By J. W. Whittemore
THE PRIVATE LIFE OF OSWALD THE OYSTER 34-35
As Told to the Louisiana Conservation Review
LOUISIANA NATURE GUARDIANS AS FUTURE CONSERVATIONISTS 36
VETIVER 38
NATURAL GAS IN LOUISIANA 39
By W. F. Chisholm
WHAT PALMS GROW IN LOUISIANA (Part III) 48
By Miriam L. Bomhard
RECENT TRENDS IN THE LEGAL CONTROL OF GROUND-WATER RESOURCES 52
By David G. Thompson and Albert G. Fiedler
OIL AND GAS WELLS COMPLETED 58
FROM LOUISIANA TO NEW ZEALAND 63
POLYMERIZATION IN THE PETROLEUM INDUSTRY 64
By J. B. Ferchaud, Jr.
EDITORIAL 66

The magnolia in bloom on the cover of this issue is reproduced from a photograph by Benjamin Franklin Leeper. Other pictures by Mr. Leeper are shown in the Birth of Louisiana's State Flower, on Page 19.

La
333
L93
v. 7

221408



(Davis Aerial Photographic Service)

■ This air-plane view of the Leeville field illustrates certain characteristic features of the terrain of South Louisiana. While it is often necessary to dig expensive canals to facilitate drilling operations, these canals offer an outlet to other canals or bayous which connect with deep water storage.

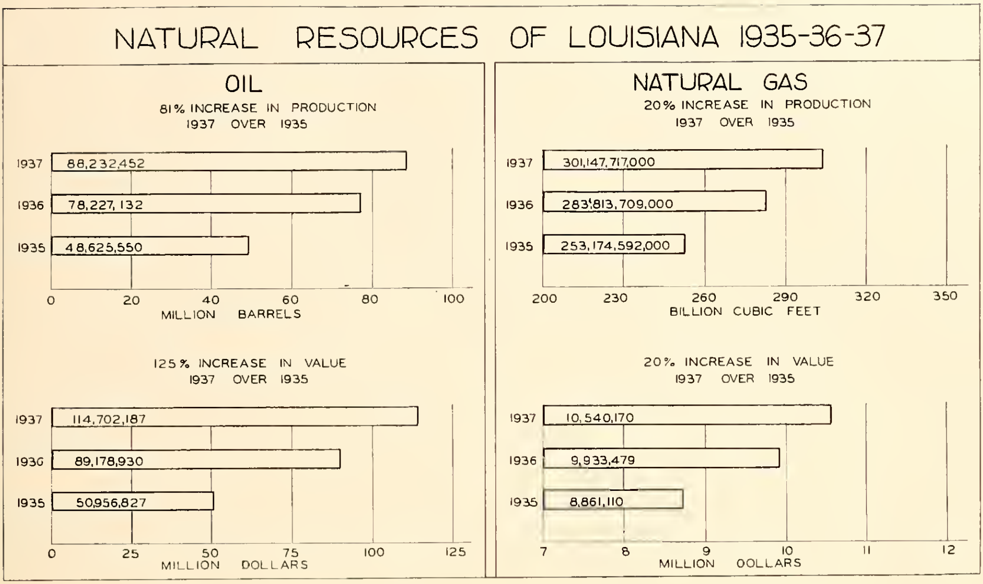
The Leeville field is located about fifty miles southwest of New Orleans, in Township 21 South, Range 22 East, Lafourche Parish. It is traversed by the Bayou Lafourche in a north-south direction, many of the producing wells being located in the bayou itself.

This dome was discovered by seismograph in 1930 by the Louisiana Land & Exploration Company, the first commercial production being obtained by the Texas Company in February, 1931.

There are numerous prolific sands on the dome at a depth of from 3,298 feet to 5,047 feet, their thickness ranging from 20 to 80 feet. Gravity of the oil varies from 20.4 degrees to 34.8 degrees A.P.I.

At the close of 1937 there were 98 producing wells in the field, their total production for the year being 2,651,187 barrels.

The new highway to Grand Isle crosses Bayou Lafourche at the field.



Significant Aspects of Louisiana's Oil Development

By

WILLIAM G. RANKIN, Commissioner
Department of Conservation

A glance at the diagram which appears at the top of this page gives us a graphic picture of the increasing importance of crude oil production to the State of Louisiana.

$114,702,187 is a lot of money in any man's country—but the real value of money depends on how it is employed.

To some men the measure of money is power, the power to impose their will on other men.

To some men the measure of money is time, the leisure hours in which to achieve a concept of happiness.

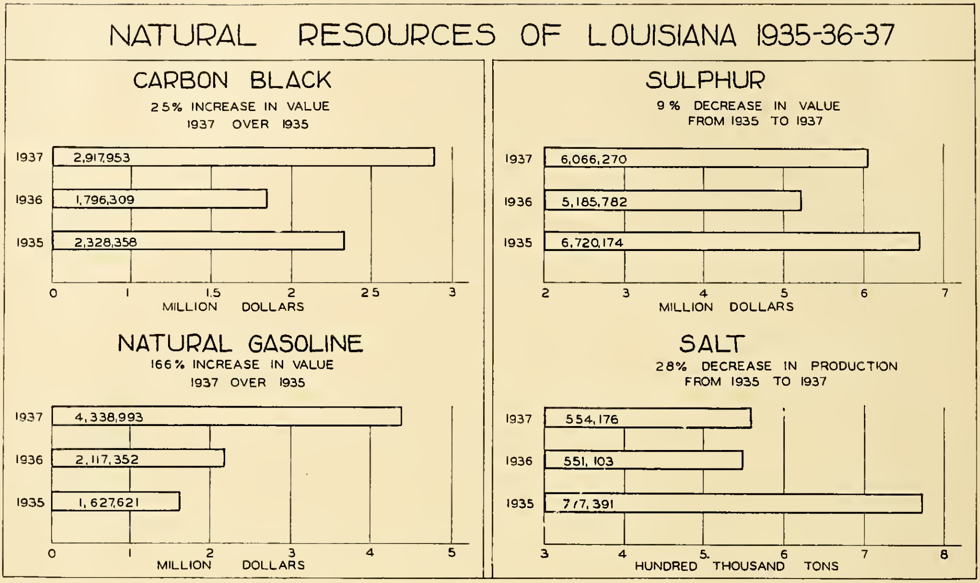
But whatever the yard-stick with which we measure the value of money we must realize that sooner or later we should take some sort of position or attitude with respect to money—that we should have some sort of scheme or plan to turn it in what we believe to be the right direction.

It would be short-sighted of us here in Louisiana to be satisfied with a severance tax of seven or eight million dollars on crude oil, with the accretion of royalties from our own oil lands, when the ground within our borders is yielding a return of over one hundred million dollars yearly from this great natural resource.

I do not mean to suggest an increase in our present rate of taxation; nor would I deprive the operators and investors of the right to reinvest their legitimate profits in any direction that their enterprise and judgment may advise. But I do think that the people of Louisiana should be fully cognizant of the possibilities of this resource which will eventually make their State one of the richest areas of its size and population that the world has ever known.

I make this statement advisedly. For several years our geologists have been telling us that one of the world's greatest petroleum reserves lies under our State; and it is perhaps significant that the development now taking place in all sections of the State, and especially the deeper drilling of our marsh-land and coastal waters, is concurrent with the recent advance of science in the technique of exploration and drilling.

Whether the interesting possibilities of Louisiana have inspired the scientists, or whether the scientists have inspired Louisiana—whether the hen preceded the egg—we now wit-



ness a convergence in the evolution of man's intelligence and those inexorable processes of Nature that have preceded us by thousands, millions of years.

In no other decade of our mechanical civilization has science had a better opportunity to demonstrate the supremacy of mind over matter as it will have in Louisiana in the immediate years to come, as our operators drill deeper and deeper to satisfy the almost insatiable appetite of the automobile and other gas-consuming engines of power—creating a vast new source of money that may or may not be wisely employed.

But there is another way in which we may demonstrate the evolution of man's intelligence, the supremacy of mind over matter—that is the way in which we employ the returns from this great natural resource. Seismograph instruments and electrical logging devices may step up the progress of science, but it is even more important that we consider the distribution of the liquid "black gold" after it leaves the producing well.

Off-hand we should say that a fair proportion of this gross income from the oil industry is spent on the ground, in the field. It is spent directly for the wages of production and transportation to the refineries. A proportion goes to management and scientific research in out-of-state oil centers, which is fair enough; and in good years a proportion is returned as net profit to the investors scattered the world over.

Now the point that I wish to emphasize is that the eyes of these investors—indeed, the eyes of the entire oil world—will be focussed on Louisiana in the next few years. They will see in all parts of our State, in all sixty-four of our parishes, the most intensive oil development that has yet taken place on this continent, or any other, for the reason that it will proceed apace and synchronize with the market demand of our expanding automotive industry, which will likewise continue to expand with the needs and desires, the increasing purchasing power, of the peoples of all the nations.

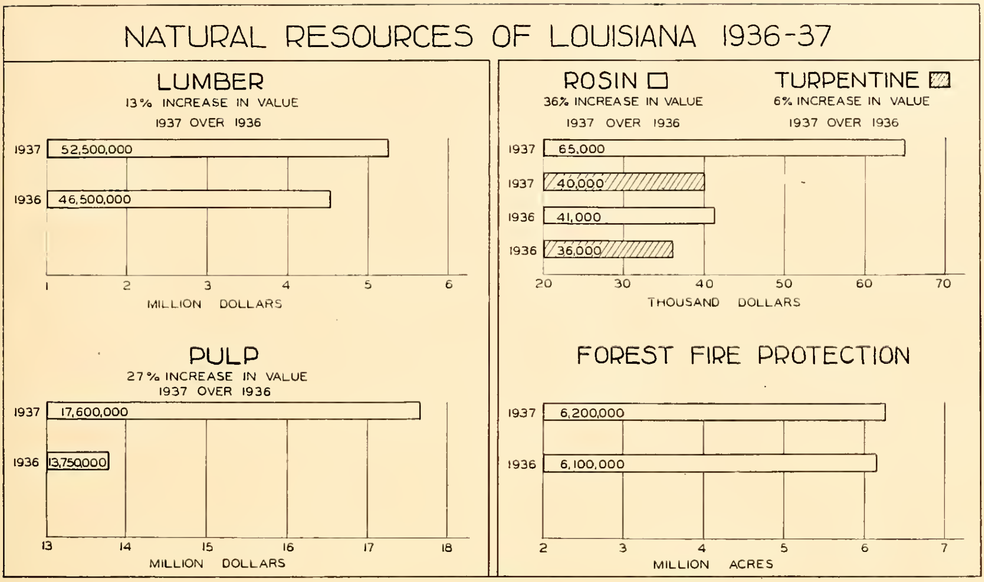
The oil dividends from Louisiana will put these investors in a receptive mood—Louisiana will be the Eldorado of their financial dreams—what is more logical than that they should re-invest in Louisiana, which has so much to offer both capital and labor in its new industrial program?

What is more logical than that this vast stream of new wealth should be guided to Louisiana, generating the power of our new industrial era and making possible the factory payroll which will add the red corpuscles to our arteries of business and trade?

This is no idle speculation. What we need in the expansion of industry is capital—and what is more logical than that it should come from those sources that are already interested in our State and have a financial stake in its future?

We will tell these investors that Louisiana not only has one of the world's greatest petroleum reserves but one of the world's greatest reserves of natural gas, which should provide cheaper fuel for industry in the years to come. In this issue of the CONSERVATION REVIEW we are able to present a thorough discussion and analysis of Louisiana's natural gas production, reserves and prospects, prepared by the Department's engineers and statisticians.

What does this intake of capital and expansion of industry mean to the average citizen of Louisiana?



Surely it means a higher level of wages and shorter working hours for labor—more money to buy the things that the higher standards of American life seem to require and more leisure time in which to enjoy them. Each of us may have a different idea of what should constitute the "superior life," but the general pattern conforms to certain standards which may only be measured in terms of money. A materialistic view, perhaps, but inescapable.

So we are back again to that $114,702,187 and what it means to you and me. If it is to mean greater happiness and contentment for all of our people, from top to bottom, we must begin to use our heads—carefully examine the liquid "black gold" that gushes from our ground, carefully consider its conversion into money and the direction that this money takes.

If we have a plan, and all pull together, we will soon begin to draw dividends that may be cashed at the bank of true values.

National forests earned $1,200,690.56 during the first quarter of the present fiscal year, reports U. S. Forest Service.

Yes, Louisiana Is Getting Hot, Mr. Jones!

Richard Lloyd Jones, publisher of the Tulsa Tribune, says Louisiana is "potentially one of the greatest" oil states of the country.

You cannot miss with this prediction, Mr. Jones, and we will give you some facts to support it.

Louisiana now ranks fourth among the oil producing states. Its production of crude oil has doubled since 1935—for 1937 it totalled 88,232,452 barrels.

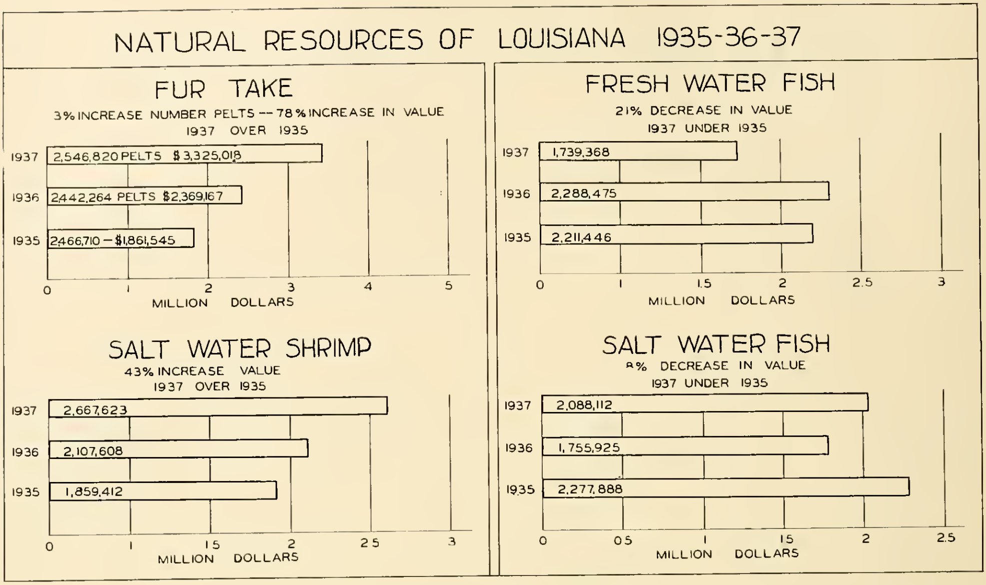
Dr. H. V. Howe, who heads the geological survey of this Department, says that one of the world's greatest petroleum reserves lies under the State of Louisiana.

Editor's Note.—The accompanying material was published in the form of an advertisement by the Louisiana Department of Conservation in the Tulsa (Okla.) Tribune of May 15th, a comprehensive review of the petroleum industry issued in connection with the International Petroleum Exposition, May 14-21.

To appreciate this statement it is necessary to understand something of the geological history of Louisiana, which differentiates it from other states and lends a peculiar interest and fascination to the work of the petroleum geologists, geophysists and paleantologists.

A very large proportion of what is now the State of Louisiana was formed by deposits of the Mississippi River in gradually shifting its course and mouths throughout those aeons of time that preceded the coming of man.

These deposits were laid down in shallow coastal waters, under conditions not far different from those that prevail to-day. These sedimentary depositions, drawn from the upper reaches of the continent, have come to be known as marine sediments; they underlie the entire south-



ern part of Louisiana, a large part of middle and northern Louisiana, from Mississippi on the east to Texas on the west. With the exception of a thin covering of Recent and Pleistocene sediments these marine deposits have a thickness of more than 30,000 feet in the southern part of the State, which is beyond the limits of our present instruments of reflection and refraction, although we are now producing from depths of over 10,000 feet.

The upheaval and projection of our salt domes through this tremendous thickness of marine sediment have created traps and reservoirs where the oil from the many oil-bearing formations has accumulated—we will leave the possibilities of these structures to your imagination, but I would like to impress on you the fact that the development now taking place in Louisiana is peculiarly a scientific process, based on scientific research and the inventive genius of man.

With this progress of science the hazard of wildcatting has been greatly reduced, the percentage of dry holes being surprisingly small.

Within the past two years we have witnessed the improvement of seismograph instruments and electrical logging devices that promise to revolutionize the technique of oil exploration and drilling—this advance has synchronized with deeper drilling in South Louisiana and we may well concede to science a full measure of credit for this performance.

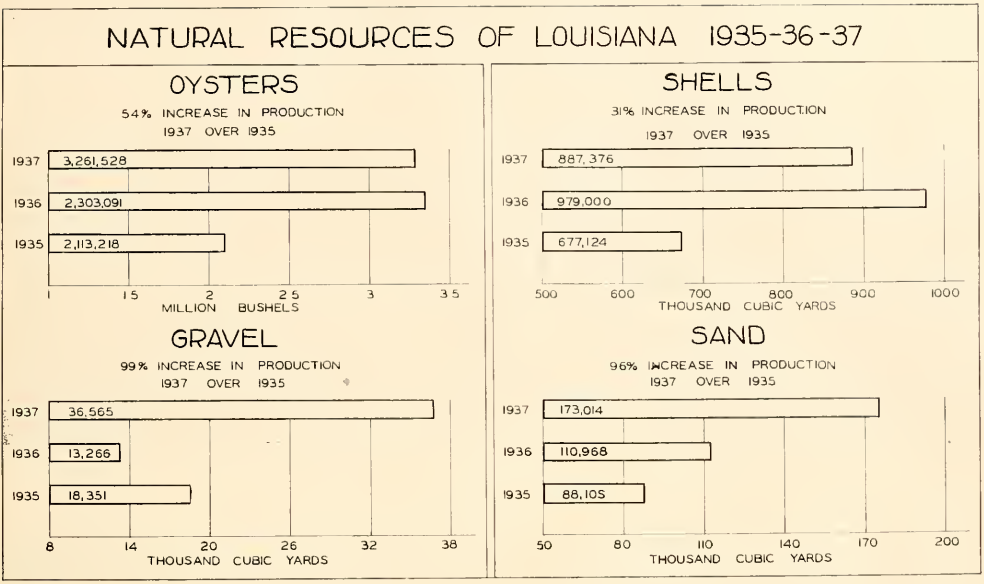
If Louisiana's oil production is coming in on the high tide of scientific achievement, we will also attain our full stature as an oil state with the faster and faster pace of the automotive industry.

In the past five years there has been an increase of fifty per cent in our domestic consumption of gasoline, and despite our temporary recession the buying power of the American people is still measured by the number of new automobiles on our highways. We may surely anticipate that our production of crude oil here in Louisiana will not lag behind the accelerated market demand ahead of us, but we must always bear in mind that our vast petroleum reserve of billions of barrels is not inexhaustible, as has been demonstrated in the case of other great reserves in other sections of the country.

I would like to give a brief outline of our policy with respect to the oil industry in Louisiana. We have been desirous of extending a helping hand to investors and operators in the development of our oil and gas resources, where this co-operation did not mean a sacrifice of our established policies of conservation in the public interest.

We have seen some of these operators in South Louisiana, drilling to great depths under difficult conditions, at an enormous cost, before the pay-off finally came, and we have naturally felt that these operators were entitled to a fair return on their investment—indeed, some sort of croix de guerre for their heroic fight against tremendous odds.

On the other hand we are under the obligation as public servants of the State of Louisiana to see that our conservation measures are duly enforced, to see that there is a minimum of waste in the recovery of this great natural resource. Nor is this policy of public interest restricted to our own state borders, for the interstate commerce in crude oil and petroleum products necessitates a consideration of their national import.



While our State is not a member of the Interstate Oil Compact Commission, we have subscribed in principle to these measures of conservation, in which Louisiana was a pioneer. In our proration orders, fixing the allowable for each field during the ensuing month, we have adhered more closely to the advice of the U. S. Bureau of Mines, based on business indices and the market trend, than the leading oil producing states of Texas, Oklahoma and California.

While we look forward to a consistent development of the oil industry in Louisiana, and a continuous increase in production, we anticipate that this will be readily absorbed by the needs and desires of a vast consuming public.

We invite the men of vision in the oil industry to turn their eyes in this direction. We are especially anxious to intrigue their interest at this time, for the reason that Louisiana has entered a new industrial era and is offering special inducements for the investment of capital and enterprise.

Louisiana is a liberal state, looking forward, not backward. It takes the position that capital, whether organized as a corporation or a small company, and labor, whether organized or not, are entitled to our support and encouragement, not merely on their own account, but because of the vital interest of all of our people in their harmonious relationship.

Louisiana's great petroleum reserve will make it one of the richest states of the Union—if the production is wisely and justly administered, it will not only justify and reward the profit incentive as a basic principle of our American standards, but it will contribute to the material well-being and happiness of all of our people.

U. S. Sportsmen Saving Canadian Wildfowl Marshes

Repairs to the continent's great "duck factory" are underway in Canada this Spring in a new movement supported by thousands of the the country's duck hunters to boost wildfowl crops by assisting Nature, according to the More Game Birds Foundation.

Organized as Ducks Unlimited, Inc., a nation-wide non-profit organization of wildfowlers, the movement aims at restoration and protection of vast duck-breeding marshes in the prairie provinces, bourne of the bulk of America's wild ducks but largely ruined in recent years by drought and agriculture.

Co-operating in the program are the Manitoba, Saskatchewan and Alberta governments and conservation organizations. Dominion officials have offered for use as waterfowl breeding sanctuaries hundreds of water conservation projects in process of establishment throughout the Canadian drought belt.

First construction work under the Ducks Unlimited program was started early in May at Big Grass Marsh, Manitoba. Formerly over 50,000 acres in extent and productive of hundreds of thousands of waterfowl, the marsh was unsuccessfully drained for agriculture. Land ownership now has largely reverted to the province through non-payment of taxes.

Ducks Unlimited's field staff of engineers and technicians is supervising erection of a simple dam across the abandoned main drainage ditch to restore the marsh. Use of the land is being provided free by the province and local authorities are co-operating in furnishing labor.

ZWOLLE FIELD BLOW-OUT BROUGHT UNDER CONTROL

■ Blowing wild through mud pump exhaust.

■ Blowing through blow-out preventer side-connections.

■ Still blowing wild, with oil coming through.

■ Oil spread over several acres.

■ Blow-out preventer—before flow line is installed.

■ Blow-out preventer opened to install flow line.

When the Well Blows Out

Procedure in Getting Flow of Oil and Gas Under Control

The oil driller's job is no easy one under the most favorable conditions. However careful he may be, whatever precautions he may take to prevent accidents and minimize the hazards of his work, there is no lack of excitement and thrills, even dangerous battles with the unseen forces of Nature, to test the calibre of his nerve and endurance.

One of the most dreaded hazards is that of the premature blow-out. While every effort is made to avoid such a catastrophe, and science is continually improving the devices and paraphenalia to anticipate such a contingency, it is nevertheless disconcerting to a degree that might well discourage a breed less hardy than the typical oil driller.

The Department of Conservation maintains a corps of engineers and immediately that trouble is reported by the driller one of these engineers is dispatched to the scene, to render any assistance in his power and to survey at first-hand the procedure of fighting the blow-out.

On the opposite page there are several views that indicate something of the character and extent of a recent blow-out in the Zwolle field, and the following report of D. E. Fuellhart, Department of Conservation engineer, explains in detail the steps that were taken to get the flow of gas and oil under control. Mr. Fuellhart writes:

"I give you herewith a description of the conditions of the J. G. Sutton and Zwolle Oil Co.'s Sabine Lumber Co. No. 1, Section 23-T7W-14W, Sabine Parish.

"As per your request of the night of the 14th, I visited the well Sunday morning, May 15, with L. L. O'Quinn of the Department, arriving at the well at 7:30 a. m.

"Saturday, the 14th, the operators were coring with a core barrel on three inch drill stem. They made about one foot new hole when the well blew out, about 3 p. m. Mr. Reeves, the driller, stated he was using ten pound mud when coring. Seven inch casing was set at 3856 feet and the total depth is 4207 feet. When the well blew out the drill stem was raised to about 18 feet off bottom.

The Blow Out Preventer

"The Cameron blow out preventer was closed around the 3-inch drill stem, flow lines were connected up to each side of the blow out preventer and turned into the mud pit. The well also flowed through the core barrel, drill stem, kelly joint, hose and mud pump into the pit. It appeared to make mostly gas through the drill stem, and more oil through the casing.

■ **Well under control, flowing into tanks.**

"At 9:15 a. m. Sunday the blow out preventer was opened and side connections, i.e. flow lines to the tanks, were connected up. The rams on the blow out preventer were closed again at 10:05 a. m. The kelly joint was then broken loose with a truck winch and the drill stem collar set down on the rams of the blow out preventer.

"The kelly joint was then backed off and raised by the truck winch line to the drilling line. Then the rotary table was raised and set aside by the same means.

"A 7" x 3" swedge with 3" valve was stabbed into the top of the blow out preventer after the drilling nipple had been removed, shutting off the flow through the drill stem, at 11:45 a. m.

"The valves on the flow line to the tanks on each side of the blow out preventer were alternately closed and positive choke nipples ½ inch and ⅜ inch installed. The flow lines to the pits were removed and the points of their connections were bull plugged. At 12:05 p. m. the well was under control, flowing through a ½ inch and ⅜ inch choke on the casing through a 125 pound W.P. separator into two 500 barrel tanks. The pressure on the tubing (drill stem) was 500 pounds.

"The gravity of the oil is 34.4 degrees A.P.I. at 98 degrees, according to Mr. Thompson, of the Standard Pipe Line Company, whose pipe line is six miles distant.

"We estimate the well capable of making several hundred barrels of oil and several million cubic feet of gas daily.

"The three boilers are located only about 100 feet from the derrick. The derrick and drilling rig appeared to be of sufficient size and in good enough condition to drill a well to this depth. Mr. Reeves, the driller, is to be commended on the calm and efficient manner in which he handled the well under these conditions.

"A master gate is on the 7 inch casing below the Cameron blow out preventer. The blow out preventer has a small leak through a plug in one side.

"The well showed no evidence of making sand or water.

"H. D. Easton is the geologist in charge of the geological work on this project."

Electrical Exploration of Drill Holes

Schlumberger Process

Electrical exploration of drill holes is a recent geophysical technique, reduced to practice only about seven years ago. It is often referred to as "Schlumberger test". The terms "electrical surveys" and "electrical logs" seem quite adequately to characterize the new process, and their use is advised.

The process is a French invention imported by the Societe de Prospection Electrique, Paris, and discovered and perfected by Messrs. C. and M. Schlumberger and their associates.

There is no need to emphasize the absolute necessity of gathering reliable and complete information on all the formations encountered in the course of drilling. From the early days, when drilling relied almost entirely on the driller's feelings, up to the present time, the oil industry has witnessed a continuous improvement in the manner of securing subsurface information. There is a constant urge to develop new means of investigation for the purpose of reducing the cost of drilling and obtaining, however, more complete and reliable data. Today, electrical measurements constitute a new step forward, towards achieving this end. They supplement the other sources of information to a great extent and, in some instances, replace them.

Electrical Resistivity Of The Rocks

Among the parameters which can be utilized for differentiating geological formations, electrical resistance of the rocks is one of the most efficient, because it varies within large limits from one formation to another. Furthermore, it can be measured easily at any depth.

We shall recall here that rocks are capable of transmitting the electric current only by means of the absorbed water which they contain. Were they entirely dry, they would be entirely non-conductive. This absorbed water contains dissolved salts, and thus constitutes the electrolyte necessary for the conduction of the current. The more electrolyte contained in a rock, and the richer this electrolyte is in dissolved salts, the greater is the conductivity of the rock. In practice, the parameter which is measured is not the conductivity, but its reciprocal value—the electrical resistivity. For practical purposes, the resistivity is expressed in ohms per meter-meter square (resistivity of a cube of 1 meter on all sides). This gives figures comprised between one and several thousand ohms, according to the constitution of the rocks.

If a rock is very compact, the quantity of moisture it contains is exceedingly small and, consequently, the resistivity is high. This is true for dense and massive hard rocks like granite, quartzite, gneiss, and marble. Among the softer rocks, gypsum, rock salt, and coal are also very resistant on account of their minute water content.

The unconsolidated formations are generally rich in water, and normally possess good electrical conductivity. It is necessary, however, to establish a definite distinction among the pervious and the impervious soft rocks. In a more or less impervious rock, like the clays, marls, and the more or less argillaceous shales, etc., the absorbed water is, so to speak, stationary in the rock. It will, therefore, contain in solution the maximum of soluble elements present in the rock, and its chemical composition will be uniform. Under such circumstances, the resistivity will generally be a reliable characteristic of the rock itself. Results are different, however, with porous formations. In sands, for instance, water may circulate quickly and, therefore, may not everywhere maintain the same composition. The electrical resistivity will be high if the water is pure, and will be low if the water is appreciably mineralized. The electrical parameter, then, will characterize the liquid enclosed in the rock, rather than the rock itself.

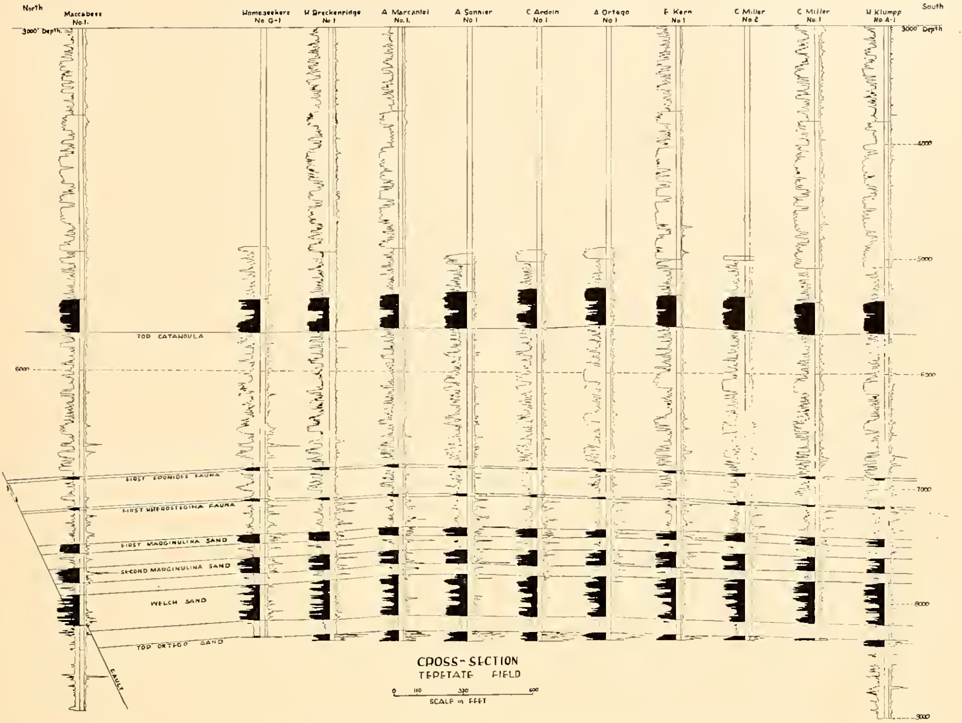
It is important to mention here the case in which the fluid contained in the rock is not a conductive electrolyte, but an insulating liquid. This occurs when porous formations are saturated with oil or natural gas. These formations are very resistant, and this fact is of great moment in their detection, as will be seen later.

The influence of temperature needs also to be briefly mentioned. An increase of temperature decreases the resistivity of the rocks for two reasons: 1, the resistivity of an electrolyte of a given concentration decreases with the temperature; 2, the percentage of dissolved salts increases with the temperature. Roughly speaking, the specific resistance decreases by one-half for an increase of 90 deg. F. This fact has an appreciable influence on the resistivity measurements made in drill holes, since temperature differences of 90 deg. F. between the surface and the bottom of a hole may be encountered. For this reason the electrical resistivity will have a tendency to decrease with increasing depths.

If temperature thus plays an appreciable role in the variations of the resistivity—pressure, on the other hand, does not seem to have any marked influence, in spite of the fact that it reaches high figures at the bottom of the holes.

Resistivity Measurements In a Drill Hole

First of all it should be mentioned that resistivity measurements can be made only in the uncased part of the hole.



CROSS-SECTION
TEPETATE FIELD

The measuring device usually employed is shown in Fig. 1. It comprises three insulated cables, 1, 2, and 3, which are lowered into the drill hole. Three electrodes, A, M, and N, are attached to the lower ends of these cables, and dip into the water or mud filling the hole. The distances AM=r and AN=r' are supposed to be large in comparison with the diameter of the hole; they are, for instance, 10 to 20 times greater. The electrode A is used to send the current into the ground, and electrodes M and N to measure the difference of potential caused between these two points by the passage of the current through the ground.

In order to cause a current to flow into the ground, the electrode A is connected by means of an insulated cable, 1, to one of the poles of a battery, E, located at the surface, of which the other pole is grounded to any given earth contact, B, in the vicinity of the drill hole. The casing frequently constitutes this second ground, B. In order to measure the differences of potential between M and N, these electrodes are connected by means of two insulated cables, 2 and 3, to the terminals of a potentiometer, P, located at the surface. Knowing the distances r and r', the intensity, i, of the current passed through the ground, and the difference of potential, V, between M and N (which is measured by the potentiometer), the average resistivity of the ground, R, in the region of the measuring arrangement, AMN, can be easily calculated.

It is given by the formula:

$$R = 4 \frac{v}{i} \frac{r\,r'}{r' - r}$$

If the ground were homogeneous, such measured resistivity would be the specific resistivity of the formations; but this is not the case, and the resistivity measured is, therefore, only apparent or relative. Specific or absolute resistivity could be calculated from the resistivity measured by rather complicated mathematical treatment, taking into account the diameter of the hole, the resistivity of the mud, the thickness of the layer considered, etc.

Spontaneous Electrical Phenomena In Drill Holes

In the course of the resistivity surveys made inside of drill holes, new and very important phenomena were discovered which had a considerable bearing on the value of the process. It is the discovery of currents spontaneously generated inside drill holes.

These phenomena are not at all negligible. Experience actually shows that over distances of a few feet differences of potential, ranging from a few millivolts up to 200 millivolts, can be measured.

There are two main causes for these spontaneously-generated currents:

1. ELECTROFILTRATION

When an electrolyte is caused to flow through a sheet made of a pervious, solid dielectric, an electromotive force occurs between the two sides of the sheet. This electromotive force is proportional to the pressure and to the electrical resistivity of the liquid, and is inversely proportional to its viscosity. It is independent of the thickness of the filtering sheet, and of the radii and number of pores of the pervious medium. It may be expressed by the following formula:

$$E = m \frac{R \quad P}{V}$$

in which:

E = the electromotive force of filtration.

P = the pressure of the liquid.

R = the electrical resistivity of the liquid.

V = the viscosity of the liquid.

m = a constant factor which depends on the porous medium.

In drill holes the water of the hole plays the part of electrolyte, and the porous layer is the dielectric. The electromotive force is then proportional to the resistivity of the mud and to the pressure inside of the layer.

The direction of the current is the same as the direction of the filtration and, in most cases, the current lines enter the layer.

In other words, it is as if, in front of a porous layer, the wall of the hole were loaded with negative electricity.

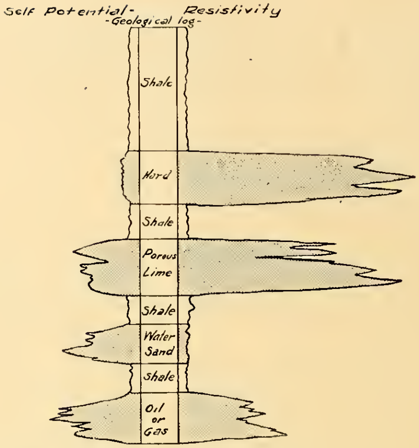
As a result, a potential profile made along a drill hole will show in front of a porous layer a negative depression. The sign of this phenomenon can be reversed, becoming positive if the pressure of the formation is higher than the hydrostatic head, in which case the formation discharges fluid in the hole.

2. ELECTRO-OSMOSIS

It is a well-known fact that if two electrolytes are in contact (contact realized, for instance, by means of a semi-permeable sheet) an electromotive force is generated.

In drill holes, the electrolytes in contact are the mud on one side and the salt water in the porous layer on the other. This salt water exists not only in salt-water sands, but also in oil sands in the state of capillary or absorbed water.

In most cases the salt water in the sand is saltier than the mud; the lines of current then enter the layer—and under such conditions the potential profile, as is the case for electrofiltration, will show a negative anomaly. In this instance the two phenomena, electrofiltration and electro-osmosis, have the same sign, and add their action to each other. The reverse case is also possible.



Determination of the Contents of the Formations

In the early stage of the use of the spontaneous potential measurements, it was thought that the electrofiltration phenomenon was mainly responsible for the negative disturbances obtained. Extensive work and experiments in the field proved, however, that electrofiltration alone could not explain entirely the spontaneous phenomenon measured. In particular, it was discovered that the differences of potential were not always proportional to the pressure of the mud. Also, experiments made at Baku (U.S.S.R.), in changing the salinity of the mud, established definitely that part of the spontaneous potentials observed was due to osmotic causes.

At any rate, both phenomena are always taking place in front of a porous layer. The diagram of spontaneous potential is referred to as "self-potential log".

This diagram is of paramount importance for the detection of porous layers and for the differentiation between impervious resistive formations, such as granite, quartzite, etc., and pervious resistant formations, such as oil or gas sand. As is the case for the resistivity log which shows only apparent resistivities, the self-potential log does not represent the absolute porosity (percentage of open space in terms of volume). It is merely a qualitative factor depending upon electrofiltration and electro-osmosis.

Spontaneous Potential Measurements Inside Drill Holes

The spontaneous potential existing in drill holes can be easily measured.

An electrode, A (Fig. 2), is fixed to one of the insulated conductors of the tricable, and is lowered into the hole to various depths by means of a winch. The upper end of the conductor is connected to one of the terminals of a potentiometer, P, of which the other terminal is connected by an insulated wire to a second electrode, B, grounded to a fixed point at the surface. The potential of the latter electrode is arbitrarily assumed to be equal to zero. For each position of the movable electrode within the drill hole the potentiometer will, therefore, give the value of the potential at this particular point. In practice, the recording apparatus used for registering the resistivity diagrams is employed, and a continuous graph of the natural potential inside the drill hole is obtained. The smallest variations of this quantity can be observed. It goes without saying that the measurements can be performed only in the uncased part of the hole.

APPLICATIONS OF ELECTRICAL DIAGRAMS

Sub-Surface Correlations

As explained above the resistivities and self-potential reactions vary greatly according to formations. Therefore these graphs show important variations and have characteristic shape. On the contrary the electrical reactions of the same geological formations remain somewhat constant—at least in a given field. As a result, the electrical diagrams of two neighboring wells show very similar shapes; sometimes they are practically identical. This similarity extends generally all through a field, and sometimes covers a large territory. It is then very easy to establish a link between certain peculiarities of the electrical diagrams with the certain geological horizons, and to identify these horizons afterwards in other wells by electrical measurements. The correlation problem is, therefore, solved.

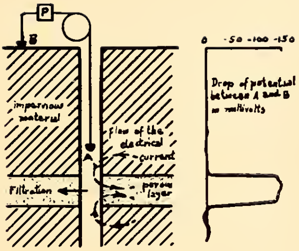

P
B
0 -50 -100 -150
Drop of potential between A and B in millivolts
impervious material
flow of the electrical current
A
Filtration
porous layer

Fig. 1. Schematic View of Electrical Surveys in Drill Holes.

In the Gulf Coast fields correlations are obtained more easily with the self-potential diagram. This is due to the generally high salinity of the formations, which does not allow a large variation of the resistivity figures.

Figure 3 shows interesting cross sections of the Tepetate field in the Acadia Parish, Louisiana, where some faults have been disclosed. The correlation between the several wells is very striking. Undoubtedly, in the days before electrical logging, it would have been difficult to recognize them with such accuracy. In fact, in practically every oil field in Louisiana, the use of the Schlumberger process has become a regular part of the exploitation technique.

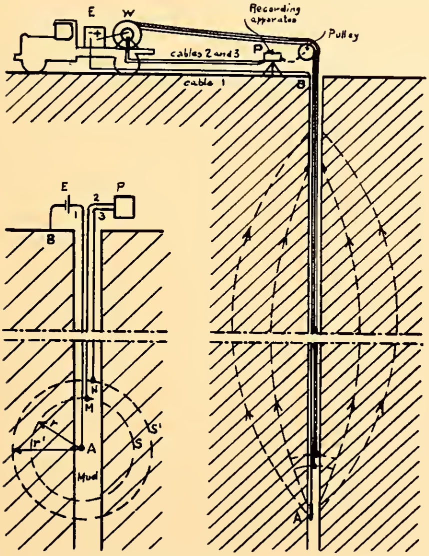


Fig. 2. Electromotive Force of Filtration Generated in a Drill Hole by a Porous Layer.

Studies of the Formations

Economically, correlations and tectonic studies constitute a great progress. In fact, there is no better method of working out the subsurface geology except by coring continuously, a process which would be very expensive.

There are other uses of the electrical diagrams which result from the detailed study of each disturbance observed with the view of determining its lithological character and the nature of the fluid contained therein.

Of course, such interpretation cannot strictly be made in geological or paleontological terms. However, the simultaneous examination of the resistivity and self-potential diagrams will furnish, in most cases, good clues as to the lithological nature of the formations encountered, especially as far as oil geology is concerned.

The main principles used in the interpretation are the following:

1. Shales, clays, marls are homogeneous and impervious. They generally show a low resistivity and have no self-potential.

2. Hard formations, like gypsum or compact lime, have very high resistivity and no self-potential.

3. An intermediate example between (1) and (2) is the porous lime, which possesses a high resistivity but shows a fairly good self-potential.

4. Water sands which in the oil fields are very often salty. They have a low resistivity (sometimes smaller than that of group (1), but show very good self-potential with negative potentials.

5. Oil or gas sands carrying insulating fluid have a high resistivity and a good self-potential with negative potentials.

Figure 4 illustrates these different points with actual field results.

Special Survey of Productive Horizons

In addition to locating productive horizons, the two electrical diagrams make it possible to study them in detail, and even sometimes to have an idea of their potential production.

Oil is a perfect insulator, electrically speaking; and if oil sands carry a small amount of current, it is only because of the capillary or absorbed water which is always more or less present around the sand grains. Hence, in general, the fact that the higher the oil saturation, the higher the resistivity. In addition, a high pressure prevents the mud from invading the sand too far, with the result that the resistivity is higher. Therefore, as a matter of general rule, there exists for the same horizon a relation between the resistivity and the potential production. It is evident that the comparison of the resistivities cannot be made between different horizons and different fields. Very likely, such comparison would lead to wrong conclusions.

Conclusion

An endeavor has been made in the foregoing to give an idea of the principles applied in electrical surveys of drill holes and to outline the principal applications thereof.

Several economical uses of the process appear during its progressive adaptation to a given oil territory.

At first, electrical surveys constitute a new line of investigation which supplements economically the information obtained by other recognized systems such as mechanical coring, paleontological analysis, cuttings, etc.

The second stage is reached when it appears that the indications obtained by the new process are as safe as those given by mechanical coring. Electrical surveys then have an industrial value, because they give better and more complete information at much less cost than extensive mechanical coring. These advantages are already sufficient to justify the general use of the electrical method. And yet, the greatest interest lies in the fact that because of the **continuous** record obtained, no productive horizon can be "passed up" in the course of drilling. The number of productive horizons discovered by electrical surveying is now very great in many countries.

With increased speed (1,000 ft. a day drilling is not abnormal in the Gulf Coast) it is absolutely impossible for a driller to keep a satisfactory record of the formations encountered. Paleontological information from cuttings is not accurate as far as depth is concerned. Wire-line coring gives poor recovery, and is sometimes dangerous. Continuous mechanical coring would be the only way to obtain detailed and reliable information, but is an economical impossibility.

The only simple, dependable, and economical way to obtain full information at present is the electrical process. Its development has been rapid, and in some countries where it has been applied since 1929 (U.S.S.R. and Venezuela) it is being used in every hole drilled. In Roumania, where it has been applied since 1931, it is also used in practically every hole. As for the United States, it was introduced in California in 1932, in the Gulf Coast in 1933, and is fast becoming, in every field, a part of the drilling and exploitation technique.

Acknowledgment

We wish to express our appreciation to the Continental Oil Company for granting us permission to reproduce the cross-sections of the Tepetate Field.

Geological Survey

DR. H. V. HOWE, Director
School of Geology of Louisiana State University
and Director, Research Division, Louisiana
Geological Survey

C. K. MORESI, State Geologist,
Louisiana Geological Survey,
Department of Conservation

The following review of Geological Bulletin No. 8, entitled "Lower Mississippi Delta," by W. Armstrong Price appeared in the April 1938 issue of The Geographical Review:

This first comprehensive study of the lower Mississippi Delta, though published as a geological bulletin, is as interesting to the physiographer. It is indeed a milestone of physiographic research, and through it physiography again proves its ability to revitalize geological theory. It is furthermore an excellent example of a coöperative research project directed by a geologist, H. V. Howe, and a physiographer, R. J. Russell.

Russell opens the discussion by giving the two definitions of the term "delta." The classical concept is an alluvial tract of land between the branching distributaries of a river. Geologists have recently attempted to modify this definition and restrict the term to an aluvial deposit formed in a body of water at the mouth of a stream. Russell returns to the classical usage, but his discussion necessarily includes the deltaic sediments.

A delta is shown to be a dynamic, not a static, unit. "Most deltas are located in extensive alluvial tracts that are the product of delta succession. Deltaic plains consisting of an active delta and remnants of deltas of the past result from the lack of coincidence between delta positions from one term of years to the next. Practically the whole coast of Louisiana is deltaic plain of the Mississippi River. Confusion between delta and deltaic plain is responsible for the assignment of various widths to the Mississippi River Delta" (p. 6).

Russell's active delta heads at the junction of the flood plains of the Red and the Mississippi Rivers. It is flanked by elevated Pleistocene delta plains and great marginal sounds—Pontchartrain-Borgne and Vermilion-Atchafalaya. The reviewer's conception of the probable total frontage of the Recent delta plain of the Mississippi is the great bulge of the 10-fathom submerged contour from Galveston Bay to within 25 miles of Mobile Bay, including the present—Belize—active sub-delta. This would make Mississippi Sound and Galveston Bay marginal-depression estuaries of the compound Recent delta, though other factors were prominent in the development, and perhaps in the origin, of these basins.

(Turn to Page 56)

The Biologist And Conservation

By

PERCY VIOSCA, JR.

Louisiana has reached a critical point in the existence of its living natural resources, a heritage from which a large proportion of our population has for generations made its living. Thriving industries have been developed from the lavishness of nature in this remarkably favored region. Naturalists from all over the United States and from foreign countries have visited the State because of its distinctive and diversified plant and animal life.

A different situation confronts Louisiana today. There is no longer the profusion that seemed inexhaustible. The threatened depletion of many of these resources is a matter of very serious concern, imperiling, to a not inconsiderable extent, the future prosperity of the State and the occupations of thousands of its people.

The population of this section of the country has increased steadily and, as an inevitable result, there has been need of more and more land. This has resulted in the draining of areas that were formerly swamps or marshes, the habitats of many forms of life of great value to mankind. The drainage of these lands, however, has far exceeded their occupancy or use. Large portions of our wet areas, once teeming with wild life, has disappeared as such, and no benefits have resulted therefrom.

Changes In Physical Features

In addition to digging ditches and canals, civilized man has built levees, denuded the land, and polluted streams; and his methods of utilizing natural resources have usually been ruthless and unthinking. Thus the development of Louisiana is involving change in its physical features. There is no better example of the change this has produced in aquatic life than the scarcity nowadays of water bugs and water beetles around the lights on the outskirts of south Louisiana Cities, where they were formerly so numerous as to be a nuisance. As insects are not destroyed by gun, trap, net, or fishing rod, we have here convincing evidence of the existence of destructive factors more far-reaching and basic than the use of these devices to which we have usually attributed the depletion of wild species.

Depredation

In recent years interest has grown in wild plants and those readily susceptible of cultivation have become popular for garden use. Many of the more beautiful varieties have been easily available and large numbers of people, mostly unfamiliar with their requirements, have dug or pulled them up and taken them home, where, if they were not already injured beyond recovery, neglect or lack of the right conditions has resulted in total or high percentage of loss. This depredation has so reduced the supply of many rare types that not a few of those most in demand are now all but unprocurable.

The principal reason for the failure of many suggested conservation measures is that we have had practically no knowledge of the productivity of natural areas and have been ignorant of environmental relationships and geographic distribution. Only by learning more about these basic biological factors can we work out effective measures of conservation.

The importance of Louisiana as a wintering ground for wildfowl and as a general haunt of game and fur-bearing animals demands close study of the biology and ecology of the State. The agricultural and forest interests of Louisiana need more information on the distribution and economic possibilities of its plant life and the animals which forage on it. There is also a deplorable lack of knowledge of the spawning activities of numerous valuable species of fish. The increasing number of national forests and state parks and the growing number of persons interested in outdoor subjects call for the fullest study of native plants and animals for recreational as well as scientific reasons.

Quantitative studies of productivity are necessary in determining the factors bringing about the natural cycles of abundance and paucity, and will pave the way for intelligent management of wild areas, the only answer to future economic utilization. There is very little authentic data on the yields of natural areas. Recent statistical surveys of North American wild duck populations made by the Federal Bureau of Biological Survey demonstrate the importance and practical value of this type of work for planning practical conservation measures.

Biological Research

The following is an outline of some phases of biological research which have a direct bearing on conservation:—

Investigations of the relations of organisms to environment, including the effects of seasonal changes on plants and animals; the effects of soil and water composition on population densities and distribution; changes in the environment brought about by changes within biotic communities; and the economies of nature and the various food chains involved.

---

* Symposium on conservation, annual meeting, The Louisiana Academy of Sciences, Monroe, La., May 6-7, 1938.

The collection and classification of data relating to food requirements; rates of growth under conditions encountered in nature; breeding habits and seasons; and inflorescence.

The collection of statistical data bearing on the productivity of wild areas, and the effect of civilized man's influence upon this productivity.

The correlation of activities of plant and animal life with climatological data.

The study of the effects on the native biota of canalization, irrigation, ditching, etc. and the consequent changing of water levels, ground water tables, and salinity.

The making of water and soil tests for the study of edaphic relationships and for securing information applicable to aquiculture and other uses of land in addition to ordinary agriculture.

The gathering of evidence as to the relative values of restrictive measures, rehabilitation methods, and adjustment of environment for the restoration of wild life.

The study of predators and predator control.

The study of the food chains involved in fish culture.

The gathering of data on the mortality of hatchery fish when planted in natural waters.

The biological study of stream pollution and the application of the results to stream restoration.

The use of physiographic, ecological, and life history criteria and data as well as structural characters in classifying plants and animals.

California

There is a state law in California which makes it unlawful to cut, destroy or remove any native tree, shrub, fern, herb, bulb, cactus, or flower on the state or county highway rights of way and the maximum penalty is fixed at $200 or six months in jail, or both, for violation of that statute.

Prospect of Pulp and Paper Industries

The Southern Forest Experiment Station, through its "Southern Forestry Notes", has disseminated some exceedingly interesting matter relative to its recent findings in research on pulp and paper manufacture from woods of the southern forest. It states that "this research has not been conducted at the Southern Station alone, but, particularly in its chemical and physical aspects, at the Forest Products Laboratory of the Forest Service at Madison, Wisconsin, and at the laboratories of the Industrial Committee of Savannah, Inc., under Dr. Charles H. Herty.

"One of the most pertinent questions in this picture is the place of the southern forests in supplying the prospective pulpwood requirements of the Nation. It is estimated that our total national pulpwood consumption will be stabilized around 1950 at 25,000,000 cords, for all processes of pulp manufacture. Of this total 18,500,000 cords will be converted by the mechanical and sulphite process (6,600,000 cords for the newsprint, balance for other uses), 5,000,000 cords by the sulphate process, and 1,500,000 cords by the soda and semichemical processes. It is estimated that the eleven states from Virginia to eastern Texas and eastern Oklahoma can supply 2,000,000 cords (30%) of the newsprint requirements; 2,000,000 cords (17%) of the mechanical-sulphite pulp required for other purposes; 3,700,000 cords (64%) of the sulphate pulp and 300,000 cords (20%) of the soda pulp. This made a total of 7,500,000 cords of 30% of the total requirements of 25,000,000 cords. Furthermore, this is the largest contribution from any one section of the nation.

Rapid Growth

"Another important fact giving the South an advantage in pulpwood production is that of growth. Southern pine grows much faster than northern spruce and hemlock, thereby, not only producing a quicker turnover of forest capital, but, owing to the greater percentage of sapwood, a more easily converted pulpwood. Recently there was exhibited at the Southern Station sections from an 11-year-old slash pine from Georgia, a 90-year-old spruce from Nova Scotia, and an 138-year-old spruce from Maine. The diameter of the 11-year-old slash pine was 1½ inches greater than that of the 90-year-old, and only 1 inch less than that of the 138-year-old spruce.

"As shown in a recent issue of the Notes (No. 13 October, 1935), the South's advantage in production costs is also large, and will remain so, irrespective of possible future labor wage increases.

"Recent investigations indicate that in the conversion of southern pine to newsprint pulp the amount of heartwood present is not important. If the proper combination of heartwood and sapwood is reduced by appropriate mechanical and chemical processes. This result, if confirmed by repeated test, is of tremendous importance in the establishing of a newsprint industry in the South.

"In the face of this promising picture for the paper and pulp industry, a word of caution:

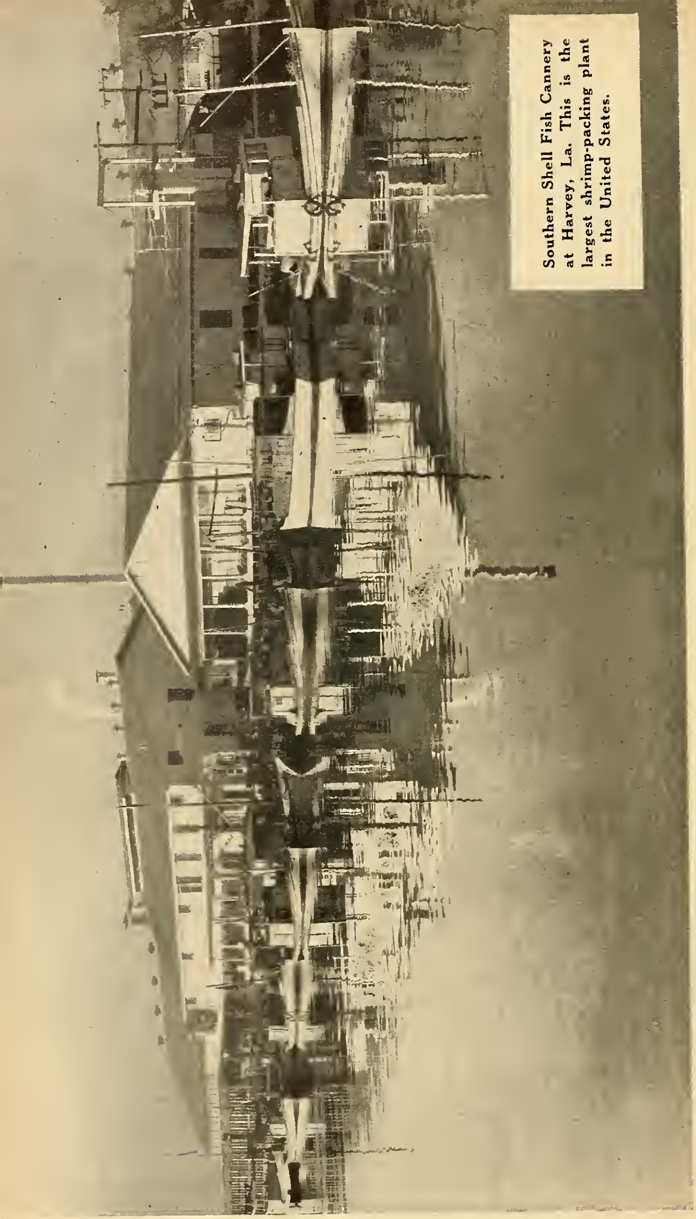
"1. There should be no greater installation than the South can support from timber not needed for the other forest-using industries.

"2. Insofar as economic circumstances will permit, new mills should be distributed throughout the region, not concentrated.

"3. Each plant should be a permanent fixture and should utilize the timber in its territory on a sustained yield basis with full regard for the needs of other forest-using industries."

MAGNOLIA IN BLOOM

The



Southern Shell Fish Cannery at Harvey, La. This is the largest shrimp-packing plant in the United States.

BEHIND THE SCENES IN THE

World's Largest Shrimp Cannery

Salt water shrimp have a definite place on the modern menu, from shrimp cocktail through the various recipes for shrimp bisque, shrimp á la Creole, shrimp stew, shrimp salads and just plain shrimp—always a favorite dish with Orleanians.

It is not generally known, however, that the largest shrimp cannery in the United States, that of the Southern Shellfish Company, is located at Harvey, La., just across the River from New Orleans. A trawling fleet of more than 100 vessels cast their nets in season and bring to this plant as high as 1500 barrels of shrimp each day during the season.

In addition to the home fleet the plant is supplied with the catches of independent fishermen. Company boats remain on the fishing grounds; its cargo boats commute back and forth from grounds to cannery, taking the catch to the cannery in well iced cargo holds. The largest of these cargo boats carries more than 100 barrels of shrimp and makes better than eleven knots an hour.

The shrimp fishing seasons are from April 15th to June 15th and from August 10th to March 1st for the inland and coastal waters—that is, within the three mile limit. It is important to note, however, that recent investigations disclose that shrimp of larger size are obtainable in large quantities in the deeper waters of the Gulf. This opens a new avenue for development, as fishing "outside" may be done between the established seasons and thereby provide the plant with shrimp throughout the entire year. These deep water shrimp are larger and more of the prawn variety.

■ This picture illustrates the sanitary conditions that prevail in a modern shrimp-packing plant. The pre-cooked shrimp, having cooled, are now passing through their third inspection.

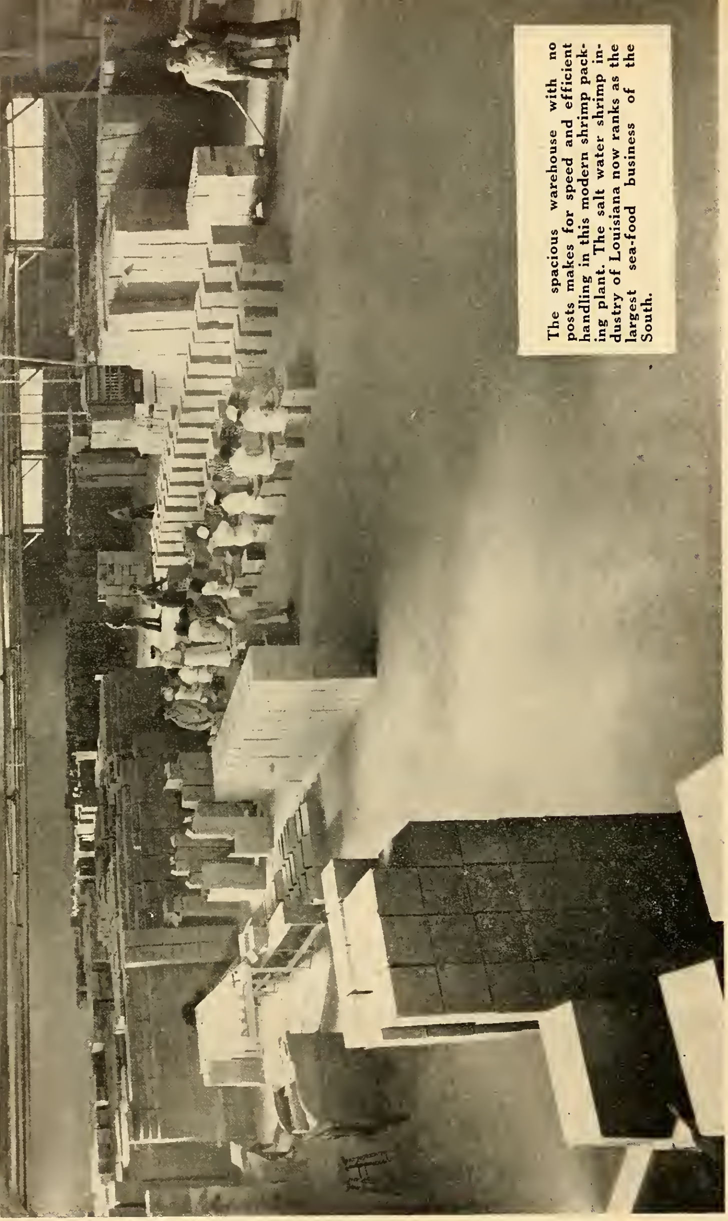
The Cargo Boats

Let's stand on the wharf while one of these boats comes in with her cargo of iced shrimp. The cargo is passed into the plant through an ingenious under-water fly-proof door directly to washing tanks where they are thoroughly cleaned by running fresh water. The catch had been previously cleaned on deck, when taken aboard, all the crabs and fish and other sea creatures that found their way into the nets having been removed and the fresh shrimp washed "overboard" before being placed in the iced cargo holds. The plant has its own ice plant, producing fifty tons per day, but in full season an additional 100 tons of ice are bought locally.

From the washing tanks the shrimp are placed on an inspection belt, so that any shrimp not fit for canning may be picked out by hand. Eleven men line this belt, one a government inspector whose carefully trained eyes detect at a glance what should be eliminated.

The inspected batch of shrimp is placed in large wire baskets, holding 105 pounds each (two to the barrel) and iced and taken to the picking shed. Shed is hardly the word when we consider a steel and glass building of two stories, open area, where five hundred men and women work under daylight conditions during the day and under inverted incandescent light at night when the plant is operating at full speed. Concrete floors and stainless steel tables tend toward the utmost in cleanliness. Well ventilated and well heated in winter, working conditions are always comfortable.

In this building the shrimp have their heads and tails removed. Icing has made this easier and when the meat has been salvaged they are placed in picking cups and carried to an inspection table where they are inspected for "proper picking," weighed and the picker credited with his or her work. All refuse or waste material is carried off in a flume of running water. The waste material,



The spacious warehouse with no posts makes for speed and efficient handling in this modern shrimp packing plant. The salt water shrimp industry of Louisiana now ranks as the largest sea-food business of the South.

such as heads and shells, are a valuable by-product.

The "Perfect" Tests

The cups of inspected shrimp are dumped into a flume which carries them off through fresh running water to a final inspection table and here is the spot where only the perfect survive the tests. Almost perfect doesn't stand a chance in this plant.

Now the raw shrimp is ready for its preparation for cooking. From the final inspection table they are dumped into ten gallon cans, which are filled with a brine solution and allowed to "soak" for 45 minutes. This process "sets" the meat. The brine solution is prepared right at the plant with a salt "precipitator" which is automatic in control end regulated to just the right degree of saturation.

The contents of these brine soaking cans are then dumped into a great hopper where the brine runs off, and the shrimp wire baskets are immersed in a boiling brine solution; the baskets traveling along a conveyor belt that takes ten minutes to make the trip, giving the shrimp that length of time to cook. This apparatus is of the Company's own construction.

After cooking the contents of the baskets are automatically dumped into a shaker, which spreads the shrimp out on a wider "cooling and drying" belt. While passing over this white rubber belt, inspection goes into play again, this time for shrimp of irregular size or appearance, which are weeded out, then and there.

Now we have cooked shrimp of various sizes, so the next process is grading. Right from the drying and cooling belt go the shrimp onto a grader which is perforated so as to allow five varieties as to size to drop through the holes into baskets. First the small shrimp pass out of sight, then the medium, followed by the large, extra large and jumbo sizes. These assorted sizes are then placed on a second blower belt for final drying.

Accurate Weights

Weighing is a matter calling for accuracy in meeting rigid specifications. Counter balance scales are used and the net weight checked when the shrimp have been placed in glass jars or cans. This is all done on stainless steel tables to insure the most sanitary conditions. After packing the cans are conducted on an endless belt to the canning machine and the cans are sealed and packed in retort baskets, in preparation for the final processing.

■ **One more shrimp is added—and the net weight is exactly correct on the scale. "Cleanliness is next to godliness" might well be taken as the motto of this modern shrimp cannery.**

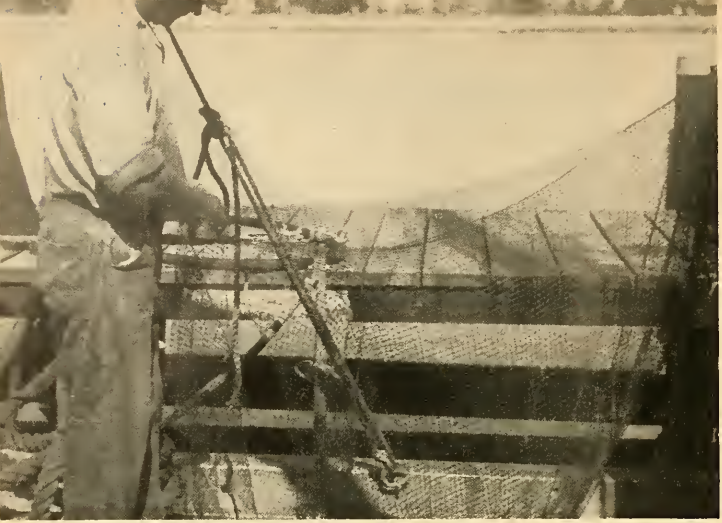
Three of the filled retort baskets are then placed in the huge kettles which are thereupon sealed and the contents subjected to live steam for specified periods. The wet pack, for instance, requires only ten minutes in the 250 degree temperature, while the dry pack requires from seventy to eighty minutes. This process insures full preservation of the true flavor, sealed in the cans.

When the baskets are removed from the kettles, the cans are allowed to cool and drain, the labels are attached, and the finished product is packed.

The huge warehouse will hold as many as 70,000 cases of marked and coded merchandise. Here is where the U. S. Food and Drug inspector makes still another inspection. A can is selected at random, opened and inspected. The term "fancy" may only be used when this inspection discloses a perfect line of merchandise. Thus the series of previous inspections testify to the importance of care, as the slightest defect now would result in an entire lot being disqualified.

Sanitation Emphasized

It should be remarked that throughout the entire process an atmosphere of cleanliness and sanitation is apparent. Openings to all buildings are doubled doored and screened. Employes are required to wash their hands thoroughly before handling the shrimp; modern equipment is provided for that purpose. All employes are declared physically sound before being employed. Aluminum paint



■ Making a protective cover for a bottom plankton net aboard the "Pelican". Fine meshed silk plankton nets are towed at various depths for the purpose of capturing eggs, larvae and young of the shrimp.

brightens all metal work. Floors are concrete and thoroughly washed down at regular intervals.

Let us go back to the picking shed for a moment. We spoke of the removal of waste material—that is, the heads and tails. These are carried off to a central conveyor where the excess water is removed through a huge press. Thence to a revolving dryer where the bulk stays until not more than 10% of the moisture remains. When final moisture tests are made, this valuable by-product is bagged in 100 pound burlap sacks and is sold as fertilizer and also as food for animals.

Through all the years since 1916 this plant has been under the supervision of its founder, C. L. Greiner, who in more recent years has had the assistance of his two sons, C. A. Greiner and Elbert F. Greiner.

Mr. Greiner says their markets are found through brokerage connections, principally, and through all the depression years the plant has continued making a profit. Their products are sold over the entire United States, throughout the United possessions. Progressive management has resulted in a steady healthy growth, bringing them to the enviable position they now occupy in the seafood industry.

The Co-operative Shrimp Investigations[1]

By MILTON J. LINDNER

During 1937, as in preceding years, the Shrimp Investigations, U. S. Bureau of Fisheries, have enjoyed the same splendid cooperation of the Louisiana Department of Conservation, the Texas Game, Fish and Oyster Commission, and the Georgia Department of Natural Resources. The headquarters of the Investigations have, as in the past, been maintained in New Orleans in offices furnished by the Louisiana Department of Conservation. The San Patricio Canning Company of Aransas Pass, Texas, has continued to furnish office space for the Texas investigator. In addition, the City of Gulfport, Mississippi, during the past year supplied dockage and locker space for the "Pelican".

There has been a steady increment into the shrimp fishery of new, larger and more powerful boats drawing larger trawls. This continued increase in the fishing effort has been under way for the last several years and is especially evident on the Atlantic Coast. The expansion of the fishing fleet in both the size of the individual boats and in their aggregate numbers has resulted in an increase in their fishing radius.

All attempts to analyze the secular trend in the abundance of the shrimp have met with little success as it has been impossible to secure the catch records required for such analysis. With the staff and funds available it has been impossible for us to gather the necessary information. Definitely we must rely upon the various States for the securing of the proper catch statistics. Therefore we urgently recommend that all States in which shrimp fishing occurs set up a method of gathering catch statistics whereby the daily catch of each boat will be recorded separately. It is from these records alone that a census of the shrimp population can be taken.

The Gulf Fishery

The most striking development in the Gulf shrimp fishery during 1937 was the large summer and fall run in Louisiana and Mississippi. The run was considerably greater than that of the immediately preceding years and was confined to the two above named States. This run further emphasizes the fact that there are good and bad years with respect to the production of shrimp, and, unless there is a breeding reserve of shrimp of age greater than one year remaining in the deeper waters beyond the range of the commercial fishery, it also shows that the number of spawners are not the important factor in determining the production of young. The 1937 Gulf spring fishery which represents the spawning population was extremely poor and unless there was an offshore spawning reserve a very small group of spawners were successful in producing a large number of offspring. It is highly probable that the effluents of the Mississippi River play an important part in determining the success of spawning.

---

[1] Published by permission of the U. S. Commissioner of Fisheries.

As stated in several preceding reports, there is evidence in the Gulf of an offshore movement during winter of large shrimp. This migration is comparable in many respects to that of the South Atlantic coast; it differs however in that it is primarily offshore and outside the present commercial fishing range, whereas the South Atlantic movement is coastwise and within the commercial fishing limits. Early in the year the "Pelican", a 78-foot Diesel vessel, was transferred to the Gulf for the purpose of making exploratory cruises in order to determine whether or not the winter migrants concentrated in sufficient quantities to permit commercial fishing. Due to insufficient funds, however, the boat was unable to operate during the fiscal year 1937 and it was further deemed advisable, because of lack of funds, to postpone operations until January, 1938.

In addition to determining winter offshore concentrations of shrimp the work of the "Pelican" should give valuable data on the length of life of the shrimp, whether or not there is an offshore spawning reserve in the Gulf, and the extent of the spawning grounds.

Arrangements have been made with Professor A. E. Parr of the Bingham Oceanographic Institute of Yale University to analyze the salinity samples secured with the "Pelican". Similar arrangements have been made with Professors H. V. Howe and R. D. Russell of the Department of Geology of Louisiana State University to analyze the bottom core samples which are taken at each trawling station.

The Texas program which has been conducted by Kenneth H. Mosher has been primarily that of sampling the commercial fishery, but during the past two seasons, through the assistance of Albert Collier, Marine Biologist of the Texas Game, Fish and Oyster Commission, tagging operations have been added.

It is known that temperature and salinity affect the behavior of the shrimp and during the past year it was determined that the tides also enter as a factor. In the vicinity of Corpus Christi, Texas, it was found that better catches of shrimp, as a rule, were made during periods of low than during periods of high water.

The Texas coastal area is generally characterized by wide and at times rapid fluctuations in temperature and salinity of the water which apparently result in sudden and yet unexplained reactions and movements of the shrimp. In order to arrive at a better understanding of the behavior of the shrimp in relation to environmental changes a new program of investigation, conducted by Mr. Collier, was initiated in January, 1938. This survey will include Aransas, Copano, and Mesquite Bays and the Gulf of Mexico adjacent to Aransas

■ **The U. S. Fisheries Ship "Pelican" at dock in the Yacht Basin, Gulfport, Mississippi.**

■ **Making a steadying sail for the "Pelican" while at sea.**

Pass. A series of stations has been established in these areas and they will be visited once each week. At each station trawl samples of the bottom fauna will be taken, surface and bottom temperature and salinity observations will be made and plankton hauls will be secured. Shore seining stations will be occupied also at regular intervals and current observations in the several Bays will be made with Skogsberg floats. The present tagging program to determine the migrations and growth of the shrimp will be continued, but with the transfer of Mr. Mosher to the California Sardine Investigations the routine sampling of the commercial catch at Aransas Pass will be discontinued.

John C. Pearson, prior to his transfer to the Shad Investigations, submitted for publication a manuscript describing the larval stages of the common shrimp and those of four other peneids. This basic work will be of considerable aid in determining the extent of the spawning grounds.

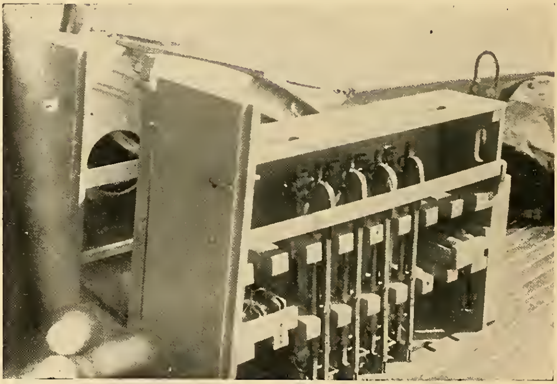
The South Atlantic Fishery

The Atlantic fleet, comprised mainly of boats originating in Florida, migrates from North Carolina to Florida with the concentrations of shrimp. As a general rule the summer and early fall fishery is most productive between North Carolina [illegible] ia. Later, however, as the [illegible] southwards the fleet also moves southerly and during late fall and winter the shrimp and the fishing fleet are concentrated in the area between St. Augustine and Cape Canaveral, Florida. During the past several years, due to the intensive fishing in the more northern areas of the rapidly expanding fleet, the Florida winter fishery is becoming less and less important. It appears evident that at least the majority of shrimp are being caught before they reach central Florida. As a result it is expected that a portion of the Atlantic fleet will move into the Gulf during the present winter.

While the supply does not show signs of serious depletion the South Atlantic shrimp fishery seems to have reached the maximum of production that can be obtained from it under the present system of management. Further, it is becoming apparent that this particular fishery is rapidly reaching a stage of over-development with respect to the amount of gear employed. Although the total catch has not declined, neither has it increased with the augmented fishing effort. Obviously if more and more gear continue to enter the fishery the economic stability of each unit will be lowered and a number of the marginal units will find it unprofitable to operate.

From our present understanding of the shrimp it appears that an increase in the total poundage of the take of the South Atlantic fishery can be secured only through better protection afforded the young. The intensified fishery is causing greater inroads on the young shrimp which in turn will decrease the total pounds landed even though depletion may not enter. As the fishing intensity increases bad shrimp years from the aspect of the fisherman will become more and more evident.

(Turn to Page 38)



■ **Box for carrying Greene-Bigelow water bottles and reversing thermometer cases on board the "Pelican". The bottles, attached to a wire rope, are lowered to any desired depth and then tripped by a heavy messenger sent down the cable. By this means a sample of the water at any depth is secured for analyses and at the same time a temperature reading of the water *in situ* is obtained.**

Tchefuncte State Park And Conservation Reservation

Giant Live Oak—Tchefuncte State Park

The Tchefuncte State Park and Conservation Reservation will include 5,800 acres purchased from the Great Southern Lumber Company. This area was known recently as the Nott Tract. It was previously called Fontainebleau Plantation by Bernard de Marigny de Mandeville, who acquired the property in 1829 from Marcelin and Amelie Bonnabel and Jean Louis Rabaud.

About 2,000 acres of the property are situated immediately east of the town of Mandeville, between Bayou Castin and Cane Bayou, and south of U. S. Highway No. 190, in St. Tammany Parish. The site extends from Lake Pontchartrain north across U. S. Highway No. 190 to a depth varying from two to three miles, and the Conservation Department has acquired the entire shore line on Lake Pontchartrain between Cane Bayou and Bayou Lacombe, a distance of approximately five miles, with a depth varying from five to ten acres.

The area allotted to the State Parks Commission for recreational purposes will consist of approximately 1,000 acres, bounded on the north by U. S. Highway No. 190, on the west by Bayou Castin, on the south by Lake Pontchartrain, and on the east by a line extending approximately north and south about halfway between Bayou Castin and Cane Bayou.

About 1,000 acres in the tract north of U. S. Highway No. 190 will be allotted to the Division of Forestry of the Conservation Department for reforestration, and another 1,000 acres north of said Highway will be allotted to the Wild Life Division of the Conservation Department as a quail hatchery and breeding ground.

South of U. S. Highway No. 190, and immediately east of the State Park area, a tract of approximately 2,000 acres will be set aside as a game preserve to be stocked with deer, wild turkey and other game. A tract of approximately 1,000 acres of marshland between Cane Bayou and Bayou Lacombe will be set aside as a refuge for muskrat, migratory wild fowl, and other wild life.

Negotiations for the purchase of the above tract were completed and the deed signed on January 31, 1938 by Daniel T. Cushing, Vice-President and General Manager of the Great Southern Lumber Company, Inc., and William G. Rankin, Commissioner of Conservation and ex-officio Chairman of the State Parks Commission.

In September 1937, at a conference arranged by Governor Richard W. Leche, and attended by him, William G. Rankin, D. T. Cushing, Delos R. Johnson, Attorney for the Great Southern Lumber Company, Lewis L. Morgan, Attorney representing the Conservation Department and the State Parks Commission, James P. Guillot, Treasurer, and N. E. Simoneaux, Secretary of the State Parks Commission, an agreement of sale was reached. In November 1937, although the deeds had not yet been signed, the State Parks Commission employed William W. Wells, who was recommended by officials of National Park Service, as Landscape Architect to prepare a preliminary master plan for development of Tchefuncte State Park.

Tchefuncte State Park—Beach on Lake Pontchartrain in Natural Condition

Two Types of Recreational Development

The preliminary master plan contemplates two separate and distinct types of recreational development. One type will include a public bathhouse to accommodate one thousand people at a time, a clubhouse or lodge to include lounge, dining-room and dance floor; individual vacation cottages will be constructed near the beach on the lake front. The above group of buildings will be located on the east end of the park near the lake.

The second type of development will cater to organized groups such as Boy and Girl Scouts, and other organizations and clubs such as the Y.M.C.A., Y.W.C.A., Y.M.H.A., etc. A separate beach and bathhouse will be developed for the group camp. In addition, it is proposed to develop foot and bridle trails and the necessary automobile roadways leading to the buildings in the service area where adequate parking grounds will be provided.

On the west side of the park on Bayou Castin, a fine harbor will be provided for larger yachts and motorboats. The lodge and vacation cottages will be located around a large lagoon already existing but which will be deepened. The extent of the lagoon, east to west, will be approximately 5,000 feet, and about 300 feet from north to south. The depth of the water will vary from three to five feet to accommodate rowboats.

Historical Plantation

The ruins of a brick yard and sugar mill (which include two well-preserved chimneys) formerly operated by Bernard de Marigny will be included in the park area. Bernard de Marigny sold Fontainebleau Plantation to Hippolyte Griffon on February 23, 1852 on account of financial reverses, which he himself describes as follows:[1]

> "Certain persons have often asked the question 'How did Mr. Marigny lose the fortune he possessed of five or six hundred thousand dollars?' The answer to the question is as easy to make as to understand—it disappeared under the influence of events and circumstances which I could not control. In 1839 Messrs.__________ (he names five gentlemen) undertook the estimation of the value of my possessions, an estimation I judged necessary at the time of my departure for France. The amount of my fortune was fixed by these gentlemen at nine hundred fifteen thousand dollars ($915,000.00). My debts then amounted to three hundred twenty thousand ($320,000.00), two hundred eighty thousand ($280,000.00) of which represented a debt to the Citizens Bank. I rallied my resources and asked for larger terms from my creditors, for I thought I could re-establish my fortune. I had a sugar plantation and a brick yard, but to develop the sugar plantation, I needed to construct buildings, dig canals, provide equipment, and put in necessary machinery. To meet such great expenses, crops were needed. They failed in consequence of a crevasse in 1850, followed by another in 1851. That is not all; bricks fell to their lowest price (he owned a large brick yard which he worked with his slaves), and the price of sugar was reduced from 2½ to 3 cents the pound.
>
> "On this the Citizens Bank announced to me that if I did not decide to sell the plantation they would seize it. I was therefore forced to sell at a very moderate price. The Citizens Bank naturally took possession of all the products of the sugar house and of the brick yard."

The property itself is described in the deed of transfer from the Marigny to Griffon as follows:

DESCRIPTION
of
FONTAINEBLEAU PLANTATION
(In the Parish of St. Tammany)

"A certain tract of land or plantation, known as "FONTAINEBLEAU" situated in the Parish of St. Tammany in the State of Louisiana, at about fourteen arpents east from Bayou Castaing, fronting on Lake Pontchartrain, and extending up to Bayou aux Cannes, said land having in the aggregate four thousand seven hundred and ninety-four superficial arpents, and is composed of two parcels of land, according to a plan drawn by Charles Trudeau, then Surveyor General for the Province of Louisiana, dated 15th of January 1799, a certified copy of which plan is

---

[1] "Creole Families of Louisiana," by Grace King, page 49, The MacMillan Company, 1921.

Tchefuncte State Park—Beach Scene on Lake Pontchartrain in Natural Condition

annexed to an Act, executed before T. Seghers, Notary Public in this City, on the 27th of September 1834; according to which plan that portion of a yellow tincture measures four thousand and twenty superficial arpents, and the other of a black tincture has seven hundred and twenty-four superficial arpents.

"And another tract or parcel of land situated in the said Parish of St. Tammany in the upper part of Castaing Bayou, has a superficial extent of one thousand arpents, according to the survey of said land which Bernard Marigny caused to be made; said land being bounded on one side by Bayou Castaing, and on the other side by the above described tract of land or plantation, this tract of land being also comprehended under the designation of 'FONTAINEBLEAU PLANTATION.'"

The Tchefuncte Park site has a fine white sand beach approximately three miles long and large live oaks, magnolias, hardwoods, and some fine specimens of virgin pine and an abundant second growth of young pine. The ruins of the Marigny family's country home and other buildings may still be seen on the site. Young live oaks, cedar, cypress, yaupon, and palmetto grow even out of the sand beach.

Accessible To New Orleans

National Park Service officials have stated that this area will be one of the finest state parks in the United States, not only because of its unusual scenic value and historical background, but also on account of its accessibility by a concrete highway sixty miles from New Orleans over free bridges, and fifty-two miles by way of the Pontchartrain toll-bridge, and only twenty miles by water from the south shore of Lake Pontchartrain at New Orleans to the north shore of the lake at Tchefuncte State Park.

According to Gayarre[2] the site of the Tchefuncte State Park was visited in 1699 by the founder of New Orleans, Jean-Baptiste Le Moyne, Sieur de Bienville II,

> "who with a chief of the Bayagoulas for his guide, went to visit the Colapissas. They inhabited the northern shore of Lake Pontchartrain, and their domains embraced the sites now occupied by Lewisburg, Mandeville, and Fontainebleau. That tribe numbered three hundred warriors, who, in their distant hunting excursions, had been engaged in frequent skirmishes with some of the British colonists in South Carolina. When the French landed, they were informed that, two days previous, the village of the Colapissas had been attacked by a party of two hundred Chickasaws, headed by two Englishmen. These were the first tidings which the French had of their old rivals, and which proved to be the harbinger of the incessant struggle which was to continue for more than a century between the two races, and to terminate by the permanent occupation of Louisiana by the Anglo-Saxon."

Francois Philippe de Marigny de Mandeville, great grandfather of Bernard de Marigny de Mandeville, accompanied Iberville and Bienville from Canada on their first journey to establish the colony of Louisiana. He was born in Bayeux, Normandy, and served as a captain of infantry in New France. He died in New Orleans on November 4, 1728 and was buried in St. Louis Cathedral. Antoine Philippe de Marigny de Mandeville, son of Francois and grandfather of Bernard, was born at Mobile, February 28, 1722, and died in New Orleans November 6, 1779. He was likewise buried in St. Louis Cathedral. Antoine incurred the enmity of the Baron de Kerlerec, Governor of the Louisiana province and was sent to France by Kerlerec and confined for about one year in the Bastille. He was finally exonerated, however, and returned to New Orleans.

Pierre Philippe Enguerrand de Marigny de Mandeville was the son of Antoine and father of Bernard. He was born in New Orleans on June 15, 1751 and died on May 14, 1800. He was a Knight of the Royal and Military Order of St. Louis and served as captain of infantry under the Spanish government in New Orleans. He was also buried in St. Louis Cathedral. He was considered the richest man of his day in New Orleans. In 1798 he

---

[2] "History of Louisiana" (The French Domination), by Charles Gayarre, Vol. I, Page 59, New Orleans; Armand Hawkins, Publisher.

Bayou Castin, Western Boundary of Tchefuncte State Park

entertained the Duc d'Orleans (who became Louis Philippe, king of France), and his two brothers, the Comte de Beaujolais and the Duc de Montpensier.

Bernard de Marigny

Bernard Philippe de Marigny de Mandeville was the third son of Pierre Philippe and was born in New Orleans in 1785 and died here February 4, 1868. Bernard's father had loaned a large sum of money to the Duc d'Orleans when he visited New Orleans in 1798. In 1839 Bernard de Marigny accepted an invitation to visit Louis Philippe, and spent six months as a guest of the king at the court of France.

The de Marigny de Mandeville family took a prominent part in all civic affairs in New Orleans and the Louisiana colony, from the time the first settlement was made by Iberville and Bienville at Biloxi to the death of Bernard de Marigny in 1868. The history of this family is closely interwoven with the history of the colony and state of Louisiana, for the de Marigny de Mandeville family intermarried with the most prominent officials and citizens during that period.

The Tchefuncte Park site, located about half-way between New Orleans and Bogalusa, will serve not only the New Orleans area, but also the Florida parishes, and the center of population radiating from Bogalusa, which is listed by the State Planning Commission as one of the principal centers of population in Louisiana. Tchefuncte Park is the first recreational area purchased by the State Parks Commission, and will without doubt be the finest park in the state, for the reason that it is situated near the largest center of population, accessible by water and by concrete highway, and combines scenic beauty, historical interest, and the natural recreational features which are most in demand, viz., a sand beach, fine fishing, and the opportunity for boating and other aquatic sports.

That steel traps were used by Virginia fur hunters as early as 1709, at least 50 years before their use was recorded elsewhere in North America, is one of the facts revealed through research conducted by National Park Service wildlife specialists into the history of the beaver in Virginia. Old manuscripts and records are being investigated in a search for information on the beginning, development and decline of the fur trade. Special attention is being given to the trapping of beaver.

The State Forest

The State Forest at Woodworth, Rapides Parish, has been extended through the purchase of 1600 acres, making a total area of approximately 8,000 acres. The State Forest is a natural laboratory, showing all the possibilities of reforestation and timber management. A greater part of this area has been under fire protection for the past twenty-five years and contains a remarkable amount of second growth timber.

One end of the State Forest is in the watershed of the Red River bottoms; the other end lies in the Calcasieu longleaf pine ridge. All varieties of timber, from virgin cypress of the swamps to longleaf pines of the upperland areas, are represented.

A Civilian Conservation Corps camp, manned by veterans, is located on the State Forest, and during their occupancy gravel roads and bridges have been built over the entire area. In addition forest trees have been planted on all barren spots, all dead and undesirable timber has been removed and the State Forest is an outstanding showplace of the South. Facilities for recreation have been established and there are a large number of visitors daily.

Clays in Louisiana

By

J. W. WHITTEMORE*

Abstract: The geological history of the clay deposits of Louisiana is described. The physical properties of typical clays from several of the more important formations are included. It is shown that there should be a good future for the development of the clay deposits of this State because of the properties of the clay, cheap fuel, good markets, and available satisfactory labor.

Introduction

The clays of Louisiana have never been utilized to their full advantage. Brick, tile and other structural ceramic products have always been shipped into Louisiana from the neighboring states. There are many good deposits of clay located in the state that are suitable for the manufacture of many of the various types of structural clay produts and pottery. There is a vast supply of natural gas that is in nearly every case available to the better deposits of clay. Satisfactory labor is available in all sections of the state and there is sufficient concentration of population in the state to make the utilization of many of the deposits attractive. The dwindling supply of timber within the state will help to stimulate the growth of the ceramic industries that manufacture structural clay products.

Considerable work has been done on the clays of Louisiana in the past. In 1899 Ries[1] reported tests on several samples of clay and in 1917 Matson[2] reported the results of tests on several samples of clay representing the various geological outcroppings in the state.

During the years of 1926, 1927, and 1928 the Department of Conservation in cooperation with the Louisiana State University conducted a thorough survey of the ceramic resources of the state of Louisiana.

Editor's Note: This paper was presented at the Fortieth Annual Meeting of the American Ceramic Society, New Orleans, La., March 28, 1938, and printed here through the courtesy of the American Ceramic Society. Mr. Whittemore was invited by Commissioner Rankin to present this paper to the Ceramic Meetings because Mr. Whittemore conducted a clay survey of the northern part of the State for the Department of Conservation during the years 1927, 1928 and 1929.

Three bulletins[1] were published covering the northern portion of the state. This paper is largely a resume of the work covered by these three bulletins together with notes on some of the clays from the other sections of the state. All of the tests included in this paper were made according to the standards of the American Ceramic Society. Louisiana is covered chiefly with the younger geological formations. The history of the surface geology of the state starts with the late Cretaceous and continues through the various Series including extensive alluvial deposits of Recent Materials.

Midway Formation

The Midway formation of the Eocene outcrops in a very few places, and over a very limited area. These outcroppings have been thrust to the surface by salt domes. The salt domes in being thrust toward the surface have carried upward the material overlying, and due to erosion the Midway has been subsequently exposed. This clay with a low shrinkage both in drying and in firing is the material being used in many of the plants in the neighboring states making high grade ware such as sewer pipe, paving brick, etc. One of the deposits of this formation that has been thoroughly investigated is found east of Shreveport in the Bellevue oil field.

The good clay of this deposit is overlaid with six to eight feet of red and white clay which can be advantageously used with the other clay in the manufacture of many ceramic products.

Properties of Material Taken from Bellevue Oil Field Deposit:

Dry linear shrinkage—6.94%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	Salmon	0.30	......	16.51
Cone 02	Salmon	0.40	75	15.27
Cone 1	Red	0.81	232	15.22
Cone 3	Red	1.18	325	13.94
Cone 5	Dark Red	1.80	468	12.01

Sabine (Wilcox) Formation

The Sabine formation outcrops over a very extensive area of the Northwest portion of the state, especially in De Soto, Sabine, Claiborne and Red River Parishes. All of the clays from these deposits are either red or white or combinations of the two and nearly always contain iron concretions. In some cases the iron concretions are of such size and amount that the clay is of little value. Through this section the Sabine formation is predominantley continental and does not contain shells or lime. Some of the deposits such as those near Pleasant Hill have sufficient sand content with the clay so that they do not have excessive shrinkage in drying. Other good deposits of the Sabine formation are found near Keatchie, Mansfield, and Pelican. The deposit near Pelican is close to a high pressure gas well, a railroad and a main highway.

---

* Professor of Ceramic Engineering, Virginia Polytechnic Institute.

[1] Ries, Heinrich, *A Report on Louisiana Clay Samples, Louisiana Exper. Sta.*, pt. 5, 1899.

[2] Matson, C. C., *Louisiana Clays: Contributions to Economic Geology*, U. S. Geological Surveys. pp. 147-158, 1917.

[1] Bulletin No. 14, Department of Conservation, State of Louisiana, (Shreveport Area.)
Bulletin No. 16, Department of Conservation, State of Louisiana, Clays of Louisiana, (Monroe-Ruston Area).
Bulletin No. 19, Department of Conservation, State of Louisiana, Clays of Louisiana, (Alexandria Area).

The physical properties of one of the deposits near Pleasant Hill is typical of the good deposits of this formation, and are as follows:

Dry linear shrinkage—8.13%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	Red	0.40	240	16.13
Cone 02	Red	0.77	250	15.55
Cone 2	Red	1.66	325	14.89
Cone 5	Red	1.76	405	14.06
Cone 7	Red	2.42	475	12.67

Cane River

Comparatively large areas of the Cane River outcrop in Bossier Parish and in a narrow section extending along the western portion of Bienville Parish. Another narrow area extends diagonally across the lower half of Sabine Parish and the center of Natchitoches Parish. At a few places within this area good beds of clay may be found, but the sand content of most of the deposits is too high and many are highly calcareous. The best deposits of clay were found near Ringgold and Castor in Bienville Parish and many in Sabine Parish. The physical properties of the material taken from the deposit at Ringgold is typical of the others. This material is suitable for the manufacture of brick, hollow building block and many other structural clay products.

The properties of the material from the deposit near Ringgold, Bienville Parish are as follows:

Dry linear shrinkage—6.32%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	Red	3.46	154	18.36
Cone 02	Red	3.68	229	17.95
Cone 1	Red	3.88	243	17.57
Cone 3	Red	4.45	354	17.38

Sparta Sand

There are quite extensive areas of the Sparta Sand formation outcropping through the center of Bienville Parish, the northwest corner of Winn Parish and the northeast corner of Natchitoches Parish. A narrow area extends diagonally through Sabine Parish and into Natchitoches Parish just south of the Cane River formation and that extends across these Parishes.

Most of the clays of this formation contain an excessive amount of sand or are too calcareous to be of any value. However, deposits containing clay suitable for the manufacture of brick and hollow building tile may be found near Provencal in Natchitoches Parish, Fisher in Sabine Parish and Nelson, Bryceland and Danville in Bienville Parish. The properties of the clay from these deposits closely resemble those of the clays of the Cane River deposits.

Cook Mt. (Minden)

The Cook Mt. formation starts with a narrow belt running diagonally across Sabine Parish just south of the Sparta Sand outcroppings, and extends in a fan shaped area on the east side of the Red River through the northwestern part of Winn and northeastern part of Bienville Parishes, and covering nearly all of Claiborne, Lincoln and Jackson Parishes. A small portion of the eastern part of Ouachita Parish, the northeastern part of Union Parish are also covered by the Minden formation. There are many excellent deposits of clay included in these areas. In the reports of the Department of Conservation there are twenty-five deposits reported that contain clays that are suitable for the manufacture of brick, hollow building tile and many other types of structural clay products. Iron concretions, so prevalent in the area around Shreveport, are abundant in the upper strata throughout the deposits in Claiborne, Union and Lincoln Parish. It would be necessary to eliminate these in the manufacture of most ceramic products.

Within this area are several clays which fire to a white or cream color. Approximately twelve and a half miles from Minden in Claiborne Parish there is an extensive deposit made up of eight feet of white clay with streaks of red clay underlaid with six feet of plastic white clay. The bottom stratum fires to a clear white. The upper stratum fires to a light buff color. Mixtures of the two vary from white through cream. This is an exceptionally fine clay suitable for the manufacture of all structural clay products and pottery. The physical properties of this clay are as follows:

Dry linear shrinkage—3.16%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	White	1.81	455	10.83
Cone 02	White	1.89	487	8.83
Cone 1	White	1.91	495	8.51
Cone 3	White	1.84	580	8.21

Another white firing clay occurs in a deposit at Crossing, Richland Parish near the Tremont and Gulf Railroad. While this material fires to a white color it does not have the low drying shrinkage of the sample near Minden. The physical properties of this deposit are as follows:

Dry linear shrinkage—8.69%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	Cream	2.85	312	14.04
Cone 02	Cream	3.82	388	13.83
Cone 1	Cream	4.20	441	12.16
Cone 3	Cream	4.79	430	11.18

Another very similar white firing clay occurs near Chatham in Jackson Parish.

East of Dodson in Winn Parish there is a very extensive deposit of buff firing clay. The depth of the clay is only about fourteen feet but because of the large area in which it is found and because of its physical properties, it would be very satisfactory for the manufacture of brick, hollow building tile and many other structural clay products. The physical properties of this material are as follows:

Dry linear shrinkage—7.19%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	Buff	3.17	400	14.04
Cone 02	Buff	4.43	470	10.83
Cone 2	Buff	4.79	535	4.38
Cone 5	Buff	4.87	540	4.07
Cone 7	Buff	4.98	540	3.33

Most of the other deposits of clay of the Minden formation are red firing. Several of these, however, are suitable for the manufacture of most types of structural clay products. The physical properties of one of the typical red firing clays of this formation, found near Athens, Claiborne Parish, are as follows:

Dry linear shrinkage—5.24%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	Red	3.23	130	21.42
Cone 02	Red	3.12	170	20.52
Cone 1	Red	3.27	193	17.72
Cone 3	Red	3.49	330	9.69

Cockfield

The Cockfield formation outcrops over a very narrow band through Sabine Parish just south of the other members of the Claiborne group and spreads out over a fairly wide area on the east side of the Red River in southeastern Winn Parish and northern Grant Parish, a small part of northwestern La Salle Parish, the entire western half of Caldwell Parish, the southeastern corner of Jackson Parish and the southwestern corner of Ouachita Parish.

Practically all of the clays of this formation are red firing and contain a fairly large amount of sand. There are a few deposits, however, in which the sand content is low enough for the manufacture of many types of structural clay products and a few types of pottery. There are several deposits near Winnfield in Winn Parish which fire to a buff color and are quite plastic, and easily formed. They are suitable for the manufacture of practically all structural clay products and many types of pottery. The principal physical properties of a sample from a typical deposit near Winnfield are as follows:

Dry linear shrinkage—7.83%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	White	2.78	480	14.65
Cone 02	White	4.14	530	11.75
Cone 2	White	5.35	535	9.42
Cone 5	White	5.09	565	8.36
Cone 7	White	5.57	625	6.83

The good red firing clays of this formation are principally those found near Joyce of Winn Parish, Standard of La Salle Parish and Grayson and Columbia of Caldwell Parish. The physical properties of the clay from a deposit at Grayson are typical and are as follows:

Dry linear shrinkage—6.10%

Fired Properties	Color	Shrinkage %	Tensile Strength lbs/sq.in.	Absorption %
Cone 04	Red	0.00	235	16.26
Cone 02	Red	0.00	345	14.29
Cone 2	Red	1.55	455	13.92
Cone 5	Red	2.48	540	9.93
Cone 7	Red	4.23	530	9.50

Jackson

The Jackson and other formations of the Eocene Series are exposed over narrow parallel sections through the southern end of Sabine Parish and northern Vernon Parish. The Jackson expands over a comparatively large area in Grant and La Salle Parishes.

The clays of these formations are very sandy and of little value in the manufacture of ceramic products. One deposit, however, of the Jackson formation located near Summerville, La Salle Parish, fires to a buff color with good physical properties for the manufacture of many structural clay products.

Oligocene Series

All of the Clays of the Oligocene Series are very sandy and of no value in the manufacture of ceramic products.

Pascagoula

The Pascagoula formation of the Pliocene Series outcrops over a narrow band extending through Vernon and Rapides Parishes. The clays of the Pascagoula are usually yellow or gray with a very high sand content, and very often calcareous. In a few deposits such as those near Neame in Vernon Parish, and near Melder, Hineston and Elmer in Rapides Parish the absence of the calcareous material and the balance of clay and sand is such that the material is suitable for the manufacture of brick and hollow building tile.

"Citronelle"

The clays of the "Citronelle" formation of the Pleistocene closely resemble those of the Pascagoula. They are often yellow and gray clays which appear red where they have become oxidized. As a rule they are very sandy, but where the sand content is of the correct proportion with the clay they are suitable for the manufacture of brick and in some cases hollow building block.

This formation outcrops over a large area in the Southern part of Vernon and northern part of Beauregard Parishes, and extends over the southern half of Rapides Parish. On the eastern side of the Mississippi River it covers practically all of West Feliciana, East Feliciana, St. Helena, Tangipahoa, Washington and St. Tammany Parishes.

The most interesting deposits of this formation were those found near Glenmora, McNary, Le Compte, and Forest Hill in Rapides Parish; Merryville, Grabon and Bon Ami in Beauregard; and near St. Francisville in West Feliciana. The clay from the deposit near St. Francisville fires to light buff color and is suitable for the manufacture of structural clay products and many types of pottery.

Late Pleistocene and Recent

There are large areas of the Late Pleistocene and Recent materials in the northeastern portion of the state near the Mississippi River and along the Gulf. In these areas the clay strata are usually very plastic and have a high shrinkage in drying. Unless there is an accompanying sand stratum which will reduce this excessive plasticity and high drying shrinkage the deposits are of little value. All of the clays of these formations fire to a red color.

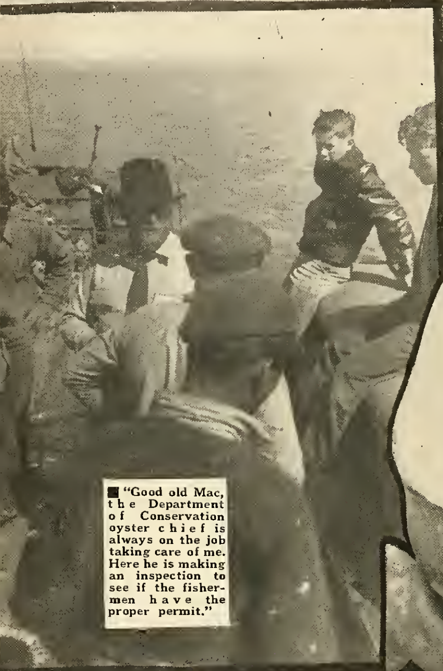
With the new methods of forming and processing many of the clays from deposits that have been considered worthless can be used for the manufacture of various ceramic products. In some cases clays with excessive sand are difficult to form with the ordinary auger extrusion machine, but with deairing they can be easily formed.

Undoubtedly in the future years, there will be a rapid growth of the ceramic industry in the State of Louisiana. The advantage of inexpensive fuel, satisfactory labor, an easy climate and accessibility to rivers which are navigable to ocean going ships will be attractive to the pottery, enameling, whiteware and glass industries.

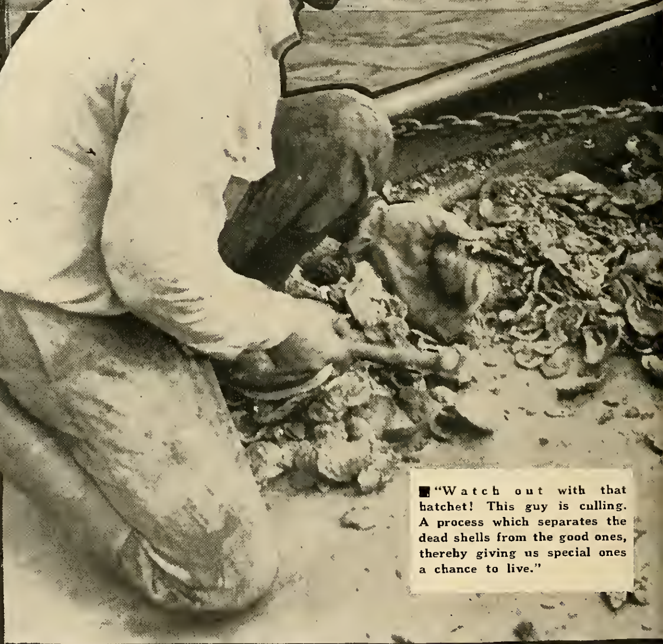
HE PRIVATE LIFE of OSWALD the OYSTER

"Howdy Folks, here I am in a Louisiana bedding ground. They'll keep me here for two years and then I'll be big enough to go to the city. Oh! Boy!"

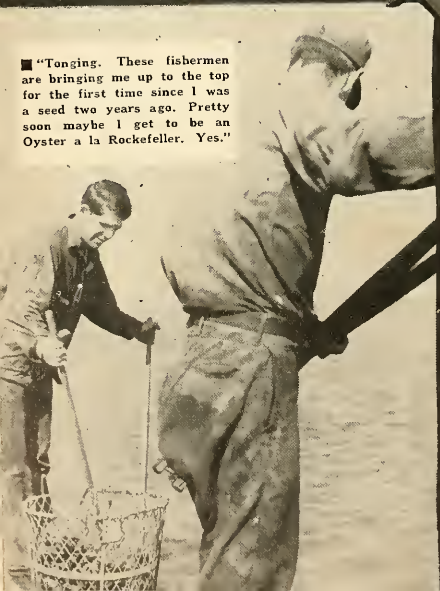
"These guys brought m from "Nigger Lake", where known as a little seed. A I'm cultivated I'll be a sp fellow, and I might even b Oyster a la Rockefeller."



"Good old Mac, the Department of Conservation oyster chief is always on the job taking care of me. Here he is making an inspection to see if the fishermen have the proper permit."



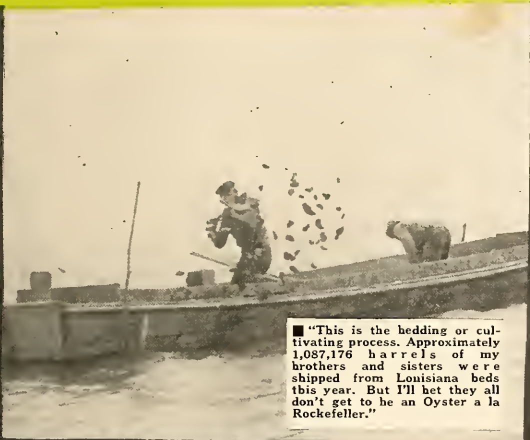
"Watch out with that hatchet! This guy is culling. A process which separates the dead shells from the good ones, thereby giving us special ones a chance to live."



"Tonging. These fishermen are bringing me up to the top for the first time since I was a seed two years ago. Pretty soon maybe I get to be an Oyster a la Rockefeller. Yes."

"Culling again. Oh Well! This time will be the last. Say do you know that Louisiana gets more than two and a quarter million dollars from little chaps like me?"

As Told to the Louisiana Conservation Review



■ "This is the bedding or cultivating process. Approximately 1,087,176 barrels of my brothers and sisters were shipped from Louisiana beds this year. But I'll bet they all don't get to be an Oyster a la Rockefeller."

■ "Sacking. Of course you know we were sacked by the bushel, of something like 3,261,568. And we are an all year 'round food with the vitamins A.B.D.G."

■ "Mister, don't you drop me in this sack. Me, I'm special fellow and maybe I be Oyster a la Rockefeller, or at least en Brochette. These other fellows, maybe they get steam canned in Biloxi, Mississippi, or sold over the counter in New Orleans. Anyway be careful."

■ "Oyster a la Rock feller. Hot Dog! told you so. Mayb now you think I' somebody. Of cours you realize that on the Louisiana oyst could do justice to dish like this."

■ "Boy! How you like this bayou country? At last I'm on my way to the city. Pretty soon now I be something you like."

■ "Well, here I go. So long folks."

■ **The camera man gives us a very good picture of the Department of Conservation exhibit at the Spring Flower and Style Show, which was staged at the municipal auditorium in March under auspices of the New Orleans Horticultural Society.**

A similar exhibit was presented by the Department at the Shreveport Flower Show.

Louisiana Nature Guardians as Future Conservationists*

Conservation is a big word for a big job—that of protecting, saving, and using well all the natural gifts of our State—the glorious State of Louisiana, which commonwealth has had from its earliest history, marvelous resources. Its boundaries hold great tracts of forests, its streams, lakes and Gulf teem with fish life, its woods are alive with fur-bearing animals and birds, and fabulous mineral wealth lies beneath its fertile acres.

Since time long passed the people of Louisiana have enjoyed these God-given gifts, but, as is often the case with things given freely and abundantly, they have been wasted and exploited.

Desperate diseases need desperate remedies, and our Department of Conservation is now waging a relentless war on such wanton despoilers. Drastic laws protecting our resources have been passed and strong enforcement divisions—both Federal and State—work to see that these laws are carried out.

But we must go beyond mere cold laws and cut-and-dried enforcement if we expect to make our citizens conservation minded. We must rear our future generations not only to respect conservation but to be personally interested in the protection and careful use of our natural heritage. In order to bring about such a condition, our work must commence with the children of today. We must arouse individual interest, and enlist the cooperation of all our Louisiana boys and girls, white and colored. They must be taught to recognize the economic value of our natural resources, to understand the reasons for our conservation laws, and learn the best way to help.in this wonderful crusade to protect the wildlife of Louisiana.

It seems that the Louisiana Nature Guardian Club, inaugurated some years ago, is particularly qualified to accomplish these aims. The Club offers the boys and girls of the State a fine opportunity to render a patriotic service to their community. It also furnishes valuable aid in teaching nature study and gives the youth of the State an interest in the preservation of our song and game birds and in the wildlife of forest and stream.

SOME OF THE THINGS THAT NATURE GUARDIANS SHOULD AND SHOULD NOT DO.

Build bird houses.

Attract birds to the school and home by putting out food and water and by building bird baths.

Learn what birds and animals are useful and try to protect them.

Don't spy and don't preach, but try to win members for your Club and to discourage cruelty by explaining the reason for caring for our natural friends.

Organize neighborhood Clubs. Get some older person to act as Club Sponsor. Vacation time is a fine time to start these neighborhood Clubs.

Make a friend of your conservation agent or warden and get him to take you and your fellow members on hikes.

Visit if possible the bird and game sanctuaries of the State.

Learn the game and fish laws of your State.

Learn the life history of the most important birds and fur animals in the State.

---

* Summary of a talk given by Mrs. Estelle Verjie Cottman, of The Department of Conservation Bureau of Education, at the Louisiana Academy of Sciences Educational Symposium, Monroe, La., May 7th, 1938.

■ This was one of the most elaborate exhibits of Louisiana wildlife that the Department has arranged. With their artistic setting of forests and wild dogwood, azalea and other flowering specie, the realistic groups of wild game elicited much favorable comment.

Avoid wilful destruction of wild flowers such as dogwood, redbud and honey-suckle; also such winter shrubs as holly, casino, pines and other evergreens, commonly used for holiday decorations.

Plant a tree whenever possible and use Louisiana's beautiful trees, shrubs and vines in landscaping the schoolgrounds and home yards under the direction of your ranger or forester.

Don't catch more fish than you really need for food.

Return undersized fish to the water to grow, and wet your hands before taking them off the hook. Removing a fish with dry hands injures its protective covering.

Be sure to get permission to hunt or fish on private land; don't trample the crops; don't forget to shut the gates after you pass through them; don't tease or hurt the owner's live stock or dogs.

Be clean, fair and sportsmanlike in everything you do, and don't forget that a Louisiana Nature Guardian is expected to be humane, loyal and an honor to his Club at all times.

By keeping these ideals constantly before our youthful Guardians and by encouraging members to love and recognize the beautiful in nature, we shall reach a place in our State's history that will be a guide and an inspiration for coming generations. AIM AT THE STARS!

Louisiana's Oil Royalties

"The State of Louisiana owns vast tracts of marsh lands and water bottoms, millions of acres, which not only produce a large revenue from fisheries and trapping but have a great potential value through the production of oil. The future oil royalty from state property should be sufficient to liquidate Louisiana's entire bonded indebtedness."—Commissioner William G. Rankin in the 13th biennial report, Department of Conservation.

James H. McGuirt, assistant state geologist, is preparing a report on the Tertiary Bryozoa of Louisiana, which are found to be similar to those described from North Carolina, Georgia, Florida and Mississippi as well as various other localities.

It is possible that these fossils will be of much assistance in correlating the formations of Louisiana with those of other states of the Gulf Coast Plains.

Dr. R. Dana Russell began field investigations on a geological report of Bienville and Jackson Parishes in the Summer of 1937. These parishes lie in the north central part of the state. Cretaceous and Tertiary formations are exposed at the surface. A number of salt domes are present in Bienville Parish, and recently gas was discovered on two new structures and in one old shallow gas field.

Field and laboratory investigations have been under way for the past year on a geological report of Natchitoches Parish by Justin Blake, geologist for the Geological Division, Department of Conservation. Lying in the central part of the State, this parish has many Tertiary formations exposed at the surface. The Angelina-Caldwell flexure crosses the parish.

State Tree Nursery

The Division of Forestry of the Department of Conservation maintains a large tree nursery on the State Forest at Woodworth, in Rapides Parish. Louisiana is one of the pioneers in the development of tree nurseries in the Gulf States. The records show that over 60,000 acres have been planted with trees. A large number of these seedlings were grown in private nurseries developed by the landowners of Louisiana.

With the advent of the Civilian Conservation Corps a tree planting program necessitated an increase in capacity of the State Nursery to fill the demands. In 1937 approximately 6,000,000 seedlings were shipped to the citizens of Louisiana and other Southern states. The demand for Louisiana seedlings has increased every year, and plans for 1938 are to increase the nursery capacity to 10,000,000 seedlings.

Vetiver

One of the natural resources of Louisiana, flourishing as a wild plant in many localities, is vetiver, which is of East Indian origin, the roots being used in the manufacture of fine vial perfume.

Vetiver is also a cultivated crop, having been grown for more than fifty years in Louisiana plantation gardens, but it is only in recent years that it has been commercialized. One farm, that of W. L. Jennings, of Hammond, has been particularly successful and now covers seven acres, yielding about 2400 pounds in the last harvest.

Seen from a distance, the vetiver crop resembles brook straw and over the entire farm hangs the odor of a strange dry perfume.

Mr. Jennings tells the story that he started with five plants and now has an estimated 40,000 plants which all came from the original five. Vetiver grows in a very odd way. "Whether it has seeds or not, I do not know," says Mr. Jennings, "but it spreads by division of the original plant. Planting goes on simultaneously with harvesting."

Mature vetiver looks like the cat-o'-nine tails you see growing in the swamps, except that the tassel is shaped like a corn tassel and is lavender colored. It is ready for harvesting after the first good frost hits it in the fall. The grassy tops are cut off to get them out of the way, and the roots are dug up, roots and all with about twenty pounds of dirt. The dirt is shaken off and the roots remain. These are the "crop". When the roots are cut off, there remains only a stump that looks like a very thick clump of grass. This clump may be divided into two, three or four parts and each part planted again, individually, in holes dug with a post hole digger, two feet apart and in rows about three feet apart.

The roots are washed by hose under 300 pounds pressure and given a tub washing before being placed in wire mesh trays for drying in the sun. On a sunny day they will dry in twelve hours and be ready for wrapping. A machine is used to wrap them like gigantic cigarettes. The greater part of the crop is wrapped in cellophane in one ounce quantities for retail, but bulk quantities are merely wrapped in strong brown paper.

The perfume is not so noticeable in the fresh roots, but more so in the cured plant. It has a peculiarly pleasant and penetrating scent which the plant will retain after years of use as a perfume agent.

Vetiver was brought to Louisiana by the early planters for landscaping, from the East Indies, where it was known as "cus-cus" and used because of its fragrance in weaving mats and curtains.

The Co-operative Shrimp Investigations

(Continued from Page 26)

Tagging experiments conducted by William W. Anderson during the past several years have shown that the larger Georgia and South Carolina shrimp move south into Florida during the winter. This past fall shrimp were tagged and released over practically the entire northern range of the fishery in order to determine whether or not large individuals from the northern limits also migrated south to become a part of the Florida winter fishery. Tagged shrimp were released from Beaufort, North Carolina, to Brunswick, Georgia. Returns have been secured in Florida from these releases—showing definitely that at least some of the North Carolina shrimp normally migrate to Florida during winter. Apparently then the South Atlantic shrimp fishery should be considered as a single unit rather than as separate fisheries each limited within the boundaries of the several states involved. Any regulatory measures or lack of regulations in one section will affect not only that section but other portions of the fishery as well, hence it is definitely advisable that the States of North Carolina, South Carolina, Georgia, and Florida attempt a co-operative and as uniform as possible management of their shrimp fisheries.

The questions now arise: What is the fate of the large shrimp that migrate from the northern areas into the Florida winter fishery? Do these shrimp normally return north in the spring to spawn? If there is a return migration do the shrimp come back to spawn in the locality in which they were reared or is the return a more or less haphazard affair? Is the fishery so intense that practically all the winter migrants are captured before they have an opportunity to return north? What changes can be expected in the future population of shrimp from a more intensified fishery? To what sizes of shrimp and at what seasons of the year can regulatory measures be most profitably applied? Do the shrimp perish at the age of one year or is there a breeding reserve in offshore areas beyond the range of the present commercial fishery?

It is expected that the current tagging program will solve many of the problems relating to the migrations along the South Atlantic coast. These studies in addition to yielding positive knowledge of the movements of the shrimp are supplying data on the intensity of the fishery and the rate of growth of the various sizes of commercial shrimp at all seasons of the year.

The extremely important question of a possible breeding reserve of shrimp of more than one year of age in offshore waters along the South Atlantic coast can not satisfactorily be answered, however, until exploratory fishing can be performed in the deeper waters. It should be possible to do this work with the "Pelican" at some future date. Thorough studies of the coastal population show that if there is any breeding reserve it would have to be in the offshore waters as there is no such stock present in any of the coastal areas.

Discarded antlers of buck deer seldom are found, principally because field mice gnaw them.

Natural Gas In Louisiana

By W. O. CHISHOLM*

The first chapter in the romantic history of natural gas in Louisiana begins with a picture of fifteen husky negro slaves laboriously toiling under a crude tripod on the banks of Cane River at Bermuda, ten miles south of Natchitoches. In 1821, P. Phanor Prudhomme, an early settler of the hardy French stock which wrested the greater part of Central Louisiana from the wilderness, started building his plantation home, and began drilling for water to meet his needs. The log of his first well recorded several gas shows in the 400 feet through which the well was drilled. The well yielded no potable water, however, and, like so many of his successors in the drilling game, Prudhomme "abandoned the hole and moved his rig to a new location." With his "dry hole," drilled with tools and drill stem hand-forged in the little blacksmith shop which still stands at the old well location, began the recorded history of natural gas in Louisiana.

Crude oil and natural gas, to most of us only accepted amenities of modern civilization, have been known, produced and utilized by many ancient peoples. Six hundred years before the coming of Christ, the tribes who lived on the shores of the Caspian and Euxine Seas beheld the flames of burning natural gas belching forth from fissures in the mountainside. These supposedly eternal fires became to them an object of worship. The Parsees under Zoroaster subjugated the Caspian tribesmen and adopted as their own idea the deification of the mountain fires. Twelve hundred years later, in 624 A.D., Heraclius wiped out the Zoroastrian cult, yet the Caspian fires still burned.

The Caspian tribesmen and the Zoroastrians visioned their mountain fires as an eternal, inexhaustible deity, and down through the ages to our own moderns they have passed a trace of the same belief. Moderns, of course, ridicule the belief in the deity of fire, but they still seem to cling tenaciously to the equally absurd superstition that a beneficient nature has placed in the ground for their use, and for the use of all future generations, an **inexhaustible** supply of cheap fuel. In no other way can we explain the fact that natural gas, which has contributed so much to the advancement of humankind from remote antiquity, has been recklessly wasted from the obscure date of its first discovery down to the present day. Centuries of reckless waste, centuries of forgotten fields, have failed to wipe out the foolhardy notion of inexhaustibility.

Under the benign influence of nature's finest fuel, many a country trading post has grown to a thriving industrial center. Natural gas made Pittsburgh, made the great industrial centers of Ohio and Indiana, yet here and there only a threat of economic extinction has served to bring a community to its senses. In 1876, gas was piped from Butler County, Pennsylvania, for use in a Pittsburgh rolling mill. For fifteen short years the steel industry thrived on the cheap fuel. Production and utilization were restricted only by the requirements of the mills. Waste knew no restriction. Pittsburghers, like Zoroaster, seemed to count on gas to eternity. Only when the white hot billets slackened on the runways, only when the steel barons foresaw the cooling of their melting pots, did the first whispers of caution find a receptive ear. Only the realization that Pittsburgh's progress was at stake, that Pittsburgh's fires might be extinguished, gave strength to that whisper until it could be heard above the roar of wasted gas.

Editor's Note.—The American Gas Journal of New York published the accompanying article, which was prepared by engineers of the Department of Conservation, as the leading feature of its May issue, for distribution at the annual meeting of the American Gas Association in New Orleans May 9-14.

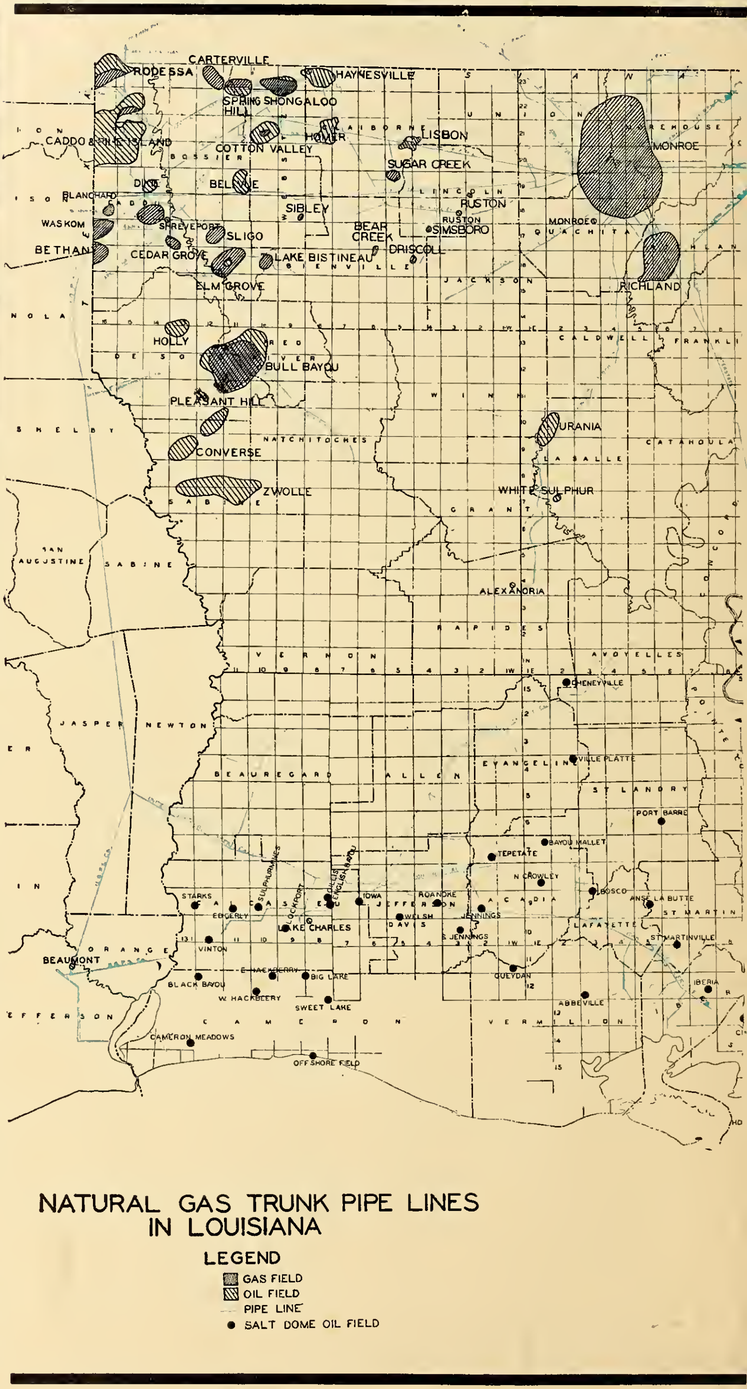
Pittsburgh is not alone. The history of natural gas follows the same general pattern wherever it is found. Gas is discovered. Immediately, surrounding land is leased. The lessor demands drilling. The royalty owner adds his clamor for more wells. The farmer puts his eggs and his butter in cold storage until the market is ready. He calls on the Government to build elevators and warehouses to store his grain. He calls on the banks and the Government for loans to carry him over a poor cotton market while he stores his cotton. He favors erection of huge dams to hold back flood waters until he can use the water to good advantage,—and undoubtedly he is right. He calls on the gas producer to produce now! He does not seem to realize that gas can be stored efficiently only in its original reservoir. Lessors of gas lands demand that the path of the producer follow the vicious circle of over-development; regardless of market conditions, each gas well must have its offset, and each offset its offset, until the field is defined. Even in those rare instances where lessors and lessees can agree on orderly production, the vast army of royalty holders demands immediate returns.

*** Engineer, Department of Conservation, State of Louisiana. Acknowledgment is made for the valuable assistance of C. P. Dunbar, statistician, and D. E. Fuellhart, engineer, of the Department of Conservation, for preparation of statistical material, maps and illustrations.**

One of the Texas Co's drilling wells in Lafitte Field, Jefferson Parish, Louisiana showing barge type of drilling rig. Derrick and power plant are mounted on barges and the barges are sunk to the canal bottom. After completion, the equipment is refloated and moved to another location. Canals are dredged out to each location as the field develops. Lafitte, one of the most prolific oil fields in the Coastal area, furnished six million cubic feet of gas per day for operation of a sulphur plant 75 miles below New Orleans.

Under these conditions, conditions for which the much abused producers are not alone to blame; conditions, the blame for which rests equally on the shoulders of the producer, the royalty trader, the lessor, and the public; conditions for which the established system of leasing is largely responsible,—under these conditions, it is not to be marvelled at that the history of almost every gas field that has come into being may be summed up under one typical outline,—discovery, over-trading, over-development, rapid and wasteful depletion of reserves, and,—death by drowning! Into this picture, as a last resort, must come the power of the state, the owner of the gas until it is reduced to possession. Through its police power, the state, by wise regulation, can break the vicious circle.

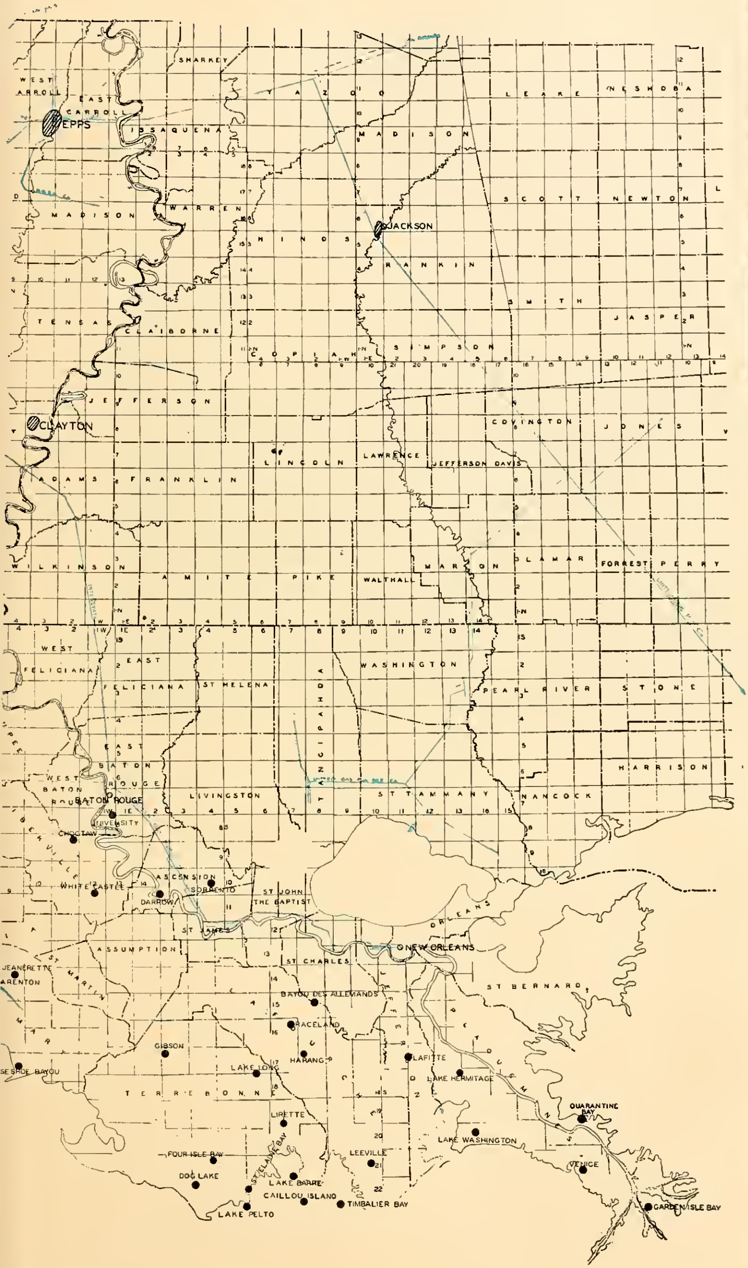
The history of Louisiana's natural gas is not unlike the history of gas wherever it has been discovered. In Louisiana, gas waste and the fight against gas waste began when old Solomon, Prudhomme's towering



NATURAL GAS TRUNK PIPE LINES IN LOUISIANA

LEGEND

▨ GAS FIELD
▧ OIL FIELD
--- PIPE LINE
● SALT DOME OIL FIELD



Drill stem and bits used in 1821 to drill 400 foot hole at Bermuda, Natchitoches Parish, Louisiana, by P. Phanor Prudhomme. These tools were all hand forged on location by old Solomon, a six foot negro slave skilled in the smithy's art. Drilling round hole, squaring up the hole, and setting cypress plank casing, Prudhomme, with 15 negro slaves as his power plant, was unable to get through hard rock at 400 ft., and abandoned hole. The well was drilled for water, but found several gas shows.

negro blacksmith hammered out his first drilling bit on the old Bermuda plantation. Prudhomme, and his drilling crew of negro slaves, saw in the gas only an obstacle to be overcome in their search for water. The discovery of oil at Spindletop brought a rush of drillers to the Southwest, and the Heywood brothers brought in Louisiana's first oil well near Jennings in 1901. This discovery led to widespread search for oil within the state. In May, 1905, Louisiana's first known gas in commercial quantities was developed in the Caddo Field north of Shreveport. Just as Phanor Prudhomme deemed his gas a hindrance to the production of water, so many of the early prospectors in North Louisiana saw in their gas only a hinderance to the production of oil. There was no market for the gas, but there was a deeply rooted idea that blowing of the gas into the air would cause the well to "go to oil." How great was the total of the gas blown into the air in those early days will never be known,—known only is the fact that it took many years of blind waste to convince even

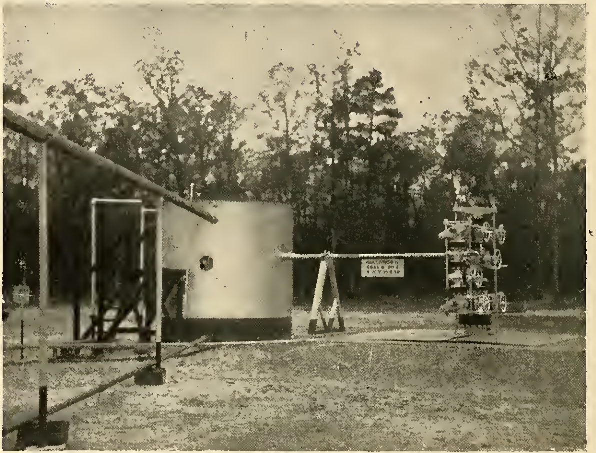
Louisiana State University

conservative operators that wells blow not into oil, but into salt water. Not until about 1917 were the people of Louisiana sufficiently aroused to the danger of gas waste to take the first real steps toward the protection of their greatest natural gift.

Domestic, Commercial, Industrial Natural Gas Consumption in Louisiana — 1935

Domestic	
Number Domestic Consumers	140,540
Domestic Consumption in Cubic Feet	6,842,000,000
Total Value at Points of Consumption in Dollars	$4,860,000
Average Value in Cents per M at Point of Consumption	71.0
Commercial	
Number Commercial Consumers	17,140
Commercial Consumption in Cubic Feet	4,171,000,000
Total Value at Points of Consumption in Dollars	$1,551,000
Average Value in Cents per M at Point of Consumption	37.2
Industrial	
Total Industrial Consumption in Cubic Feet	140,921,000,000
Total Value at Point of Consumption in Dollars	$9,990,000
Average Value in Cents per M at Point of Consumption	7.1

Source: Minerals Yearbook, 1937.



Hook-up on Woodley Petroleum Co.'s Gray B-4, Cotton Valley Field, Webster Parish, Louisiana, wellhead on right, hot water heater, built around choke, on left, producing from the Bodcau Sand, below 8000 feet. Bodcau Sand wells are drilled on 80 acre spacing, have open flow capacities of approximately 200,000,000 cubic feet per day, with bottom hole pressures of about 4000 lbs., and gas/oil ratios varying from 12000/1 to 15000/1. In order to conserve the gas, production of oil is limited by the market demand for the gas. No gas is blown into the air except during operating emergencies. It costs $125,000 to drill these wells. It costs $165,000 to kill one that got loose.

Natural Gas Industry in the United States 1936-1937

CUSTOMERS:	1937	1936	% Change
Domestic (Including House Heating)	6,502,000	6,277,000	+ 3.6
Commercial	502,000	487,000	+ 3.1
Industrial	42,000	37,000	+ 13.5
Total	7,046,000	6,801,000	+ 3.6
GAS SALES (M Cubic Feet)			
Domestic (Including House Heating)	362,021,000	343,473,000	+ 5.4
Commercial	103,933,000	97,590,000	+ 6.5
Industrial	870,909,000	789,582,000	+ 10.3
Total	1,336,863,000	1,230,645,000	+ 8.6
REVENUE (Dollars)			
Domestic (Including House Heating)	$246,932,000	$236,979,000	+ 4.2
Commercial	48,251,000	46,306,000	+ 4.2
Industrial	145,993,000	129,426,000	+ 12.8
Total	$441,176,000	$412,711,000	+ 6.9

American Gas Association Monthly, January, 1938, pp. 3-4, 1938.

The impetus needed for the development of public interest and legislative action, arose from the realization that in the Monroe Gas Field, Louisiana possessed the world's greatest gas reserve known at that time. In September, 1916, Louis Locke, a Rumanian emigrant who had worked in his youth in the oil fields of his native country, brought in the first commercial well in the Monroe Field. The subsequent drilling and rapid development of the field into a great potential reservoir of cheap fuel, soon built up an available capacity far in excess of market demand, attracted the carbon black producers from West Virginia, and began an orgy of unrestricted drilling and production. The field provided, however, a great laboratory for the state, and alarming drops in closed pressure with more alarming water encroachment served to focus the attention of the state legislature on the problem. More stringent laws were passed. Allowable withdrawals were limited to a percentage of the measured open-flow capacity of the well. Like all restrictions based on "per well allowables" alone this led to greater density of drilling and failed to solve the difficulty. In 1924, however, a practical solution was found in the gas conservation act passed by the legislature. For the first time, the amount of acreage drained by a well became the deciding factor in the size of its allowable withdrawal. In Act 252 of 1924, Louisiana presented to the gas industry the idea of the acreage factor as a controlling influence in volume of production. Since that time Louisiana has had no major difficulty in the maintenance of orderly development in its gas fields.

The conservation of gas in **gas fields** is, however, only a part of the problem of gas conservation. The waste of gas in **oil fields** has always been a cardinal sin of the oil industry, and only through bitter experience has Louisiana, like all of the oil producing states, finally learned that this conservation of natural gas in the production of crude oil is by far the greater and more difficult phase of the problem. The clash of selfish interests, the feverish demand for quick returns, the reckless line fighting that characterize most oil development under our present leasing system, have been the bane of the industry since the days of Colonel Drake. No one knows, no human mind is capable of estimating the tremendous waste of natural gas in the production of crude oil.

Section of 22" coated pipe line of Mississippi River Fuel Corporation from Monroe Field to St. Louis. Grading the ditch prior to lowering pipe.

Photo courtesy Wailes-Dove-Hermiston Corporation.

Late in 1922, the shallow Cotton Valley Field in Webster Parish came in with its discovery well making 30,000,000 cubic feet of gas per day. Subsequent drilling gave evidence of a reserve of approximating 100 billion cubic feet. After completion of six successful gas wells, one enterprising company laid a line into the field in 1923. A well on the edge of the field was then brought in making 150 barrels of oil with 30 million cubic feet of gas. Immediately the lid blew off Cotton Valley. Two hundred wells were completed within a year, practically all of them saving only a small amount of oil at the expense of the waste of a large amount of gas. One short year after the gas line was laid to the field to pipe Cotton Valley's gas to the market, there was not enough pressure left in the field to buck the line pressure, nor enough gas left in the field to feed the boilers of drilling wells. Flow in the line was reversed, and Cotton Valley boilers were fired with gas from other fields. Of the estimated 100 billion cubic feet, less than one billion was piped out of the field to market. The original gas reserve represented approximately $4,000,000. The gas recovered and piped out represented less than $40,000. In other words, in the early life of the field, nearly four million dollars in gas was wasted to recover only about eight and a half million dollars in oil. How much oil was lost in dissipation of reservoir pressure, oil lost in addition to the gas, cannot well be estimated. The lesson of Cotton Valley teaches that the blowing off of gas to accomplish a pitifully small increase in "flush" production means unwarranted increase in lifting costs, short life, unjustifiable waste of gas, and an inexcusable increase in the percentage of unrecoverable oil. The history of the Glen Rose production in the Pine Island Field, the Leeville Field in the Gulf Coast, and most of the earlier fields bears out the same lesson.

Summary of North Louisiana Natural Gas Fields in 1937

Number of Gas Wells Completed	102
Number of Wells Capable of Producing Gas	1,339
Total Daily Open Flow Capacity of Wells in Cubic Feet (Feb. 1938)	8,503,351,000
Natural Gas Production for Year 1937 in Cubic Feet	298,267,935,000
Natural Gas Production for December, 1937, in Cubic Feet	24,546,942,000
Natural Gas Burned Into Carbon Black, in Cubic Feet	39,186,564,000
Natural Gas Run Into Pipe Lines in 1937, in Cubic Feet	238,966,669,000

Source: Louisiana Department of Conservation.

The El Dorado and Smackover Fields in Arkansas, Seminole and the City Field in Oklahoma, the ridiculous scramble in the early life of the East Texas Field, even the present situation in East Texas of leg-to-leg derrick locations in the face of falling per-well allowables should have convinced the industry that it is time to call a halt to gas waste in oil production.

In her oil conservation act of 1936, Louisiana served notice that within her borders such waste would no longer be countenanced. The acreage allowable factor that has meant so much in orderly development of Louisiana gas fields was extended to oil

Continental Oil Co.'s Gasoline Plant, English Bayou Field, Calcasieu Parish.

United Gas Pipe Line Company's gasoline plant, Cotton Valley Field, Webster Parish.

field control. Pooling of small tracts was encouraged. The first major development under the 1936 law went into effect on January 1, 1937, when almost overnight a 700,000,000 cubic feet daily waste of gas was reduced to approximately 20,000,000 cubic feet. Louisiana is sold on the idea that gas can be saved in oil fields, and that the saving of oil field gas means increase in the percentage of recoverable oil.

Reference to the accompanying map will reveal that Louisiana's productive fields may be grouped into three general areas, the Sabine Uplift area centering around Shreveport in the northwestern part of the state, the Monroe-Richland-Epps gas area in the northeast, and the Gulf Coastal salt dome area along the Gulf shore. Gas production in commercial quantities, with few exceptions has been limited to the two northern areas. Only recent development has tended to link up these two northern sections through the discovery of the relatively undeveloped gas fields at Dubberly (Sibley), Simmsboro, Driscoll and Bear Creek. The Northeastern area is still confined to gas poduction only,—from the Monroe, Richland, and Epps fields. The Urania Field, producing from the Cane River Sand and the small White Sulphur Springs field which has produced small amounts of oil, from the Jackson-Lufkin contact, are minor exceptions.

Gulf Coast Salt Dome production yielded no true gas fields except the old Houma Field, near the new Lirette Oil Field in Terrebonne Parish. At the present time some relatively small amounts of gas are picked up

Natural Gas Produced in Louisiana and United States—1927-1937

	Louisiana Natural Gas Production in Millions Cubic Feet	United States Natural Gas Production in Millions Cubic Feet	Average Value at Point of Consumption in Cents per M Cubic Feet	Louisiana Production as a per cent of U. S.
1927	186,961	1,445,428	22.0	12.8
1928	227,821	1,568,139	23.2	14.5
1929	261,138	1,917,693	21.6	13.6
1930	278,341	1,943,421	21.4	14.3
1931	224,155	1,686,436	23.3	13.2
1932	201,561	1,555,990	24.7	12.9
1933	197,826	1,555,474	23.7	12.7
1934	225,713	1,770,721	22.3	12.7
1935	249,450	1,916,595	22.4	13.0
1936	283,813***	2,175,000**		13.0****
1937	301,147***	2,500,000**		12.0****

Source: Minerals Yearbook, 1937.

---

* Includes only gas delivered to consumers.
** Estimate of H. J. Struth, Am. Gas Association Monthly, February, 1938.
*** Metered production of natural gas as reported by Louisiana Department of Conservation.
**** Estimate.

Natural Gasoline Produced in Louisiana and United States 1927-1937 (In thousands of gallons)

	Louisiana Natural Gasoline Production	United States Natural Gasoline Production	Average Value at Plant in Cents per Gallon	Louisiana Production as per cent of U. S. Production
1927	44,844	1,641,144	7.2	2.7
1928	55,022	1,814,034	7.7	3.0
1929	64,957	2,233,688	7.1	2.9
1930	73,693	2,210,494	5.8	3.3
1931	58,034	1,831,918	3.5	3.2
1932	46,199	1,523,800	3.2	3.0
1933	36,973	1,420,000	3.8	2.6
1934	40,558	1,535,360	3.9	2.6
1935	49,732	1,651,986	4.3	3.0
1936	67,503	1,765,722	4.6	3.8
1937	108,474			6.0*

Source: 1927-1936 Minerals Yearbook, 1937 and 1937 Louisiana Department of Conservation.

---

* Estimate for 1937.

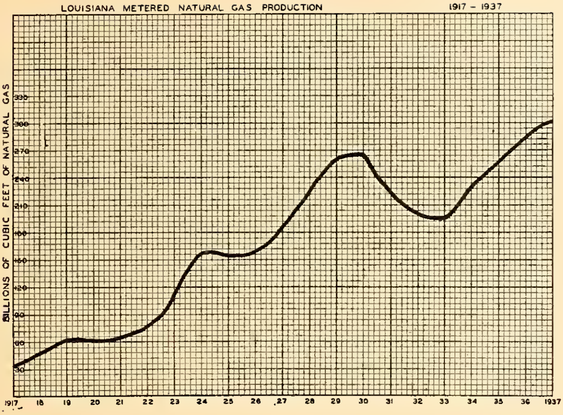
Carbon Black Produced in Louisiana and United States 1927-1936

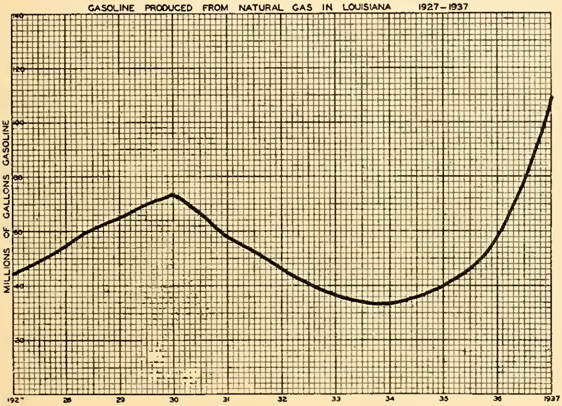
	Louisiana Carbon Black Production in M Pounds	United States Carbon Black Production in M Pounds	Average Value in Cents Per Pound	Louisiana Production as a per cent of U. S. Production
1927	124,188	198,429	5.52	62.5
1928	136,320	248,790	5.54	54.8
1929	127,345	366,442	5.11	37.5
1930	96,729	379,942	3.91	25.4
1931	57,485	280,907	3.07	20.4
1932	42,260	242,700	2.75	17.8
1933	54,470	273,125	2,78	19.9
1934	66,538	328,828	3.54	20.2
1935	64,875	352,749	3.90	18.3
1936	59,201	411,345	3.92	14.3
1937	66,317*			

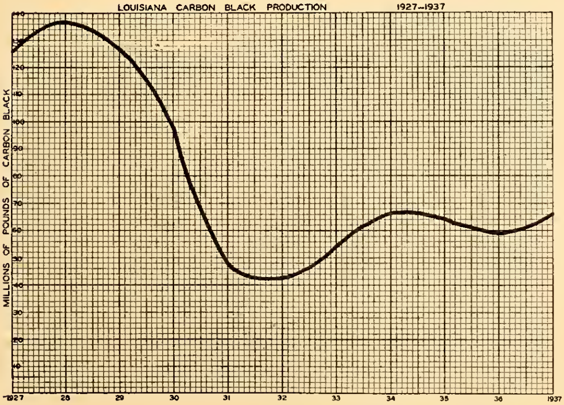
Source: Minerals Yearbook, 1937.

---

* Louisiana Department of Conservation figures for 1937.







Louisiana Metered Natural Gas Production 1917-1937

(M Cubic Feet at 10 oz. pressure)

1917	35,000,000*
1918	45,869,346
1919	62,240,585
1920	60,625,156
1921	62,659,857
1922	76,595,852
1923	111,891,169
1924	159,566,050
1925	156,615,000
1926	159,296,000
1927	186,961,000
1928	227,821,000
1929	262,680,782
1930	266,380,184
1931	222,471,691
1932	198,694,147
1933	193,202,645
1934	230,292,473
1935	253,174,592
1936	283,813,709
1937	301,147,717
Total	3,532,770,955**

*Estimate.
**Includes all metered gas produced in Louisiana prior to 1937.
Source: Department of Conservation.

by the pipe lines from several of the domes, but with the exception of Tepetate and Lafitte the commercial production of gas is relatively unimportant. Tepetate feeds a pipe line providing gas for the Mathieson Chemical plant at Lake Charles, and Lafitte provides gas for the operation of the sulphur development at Lake Washington. However, the recent deeper fields have in some cases shown a tendency to high gas-oil ratios, and it is quite possible that the Coastal area may yet assume a place of importance in commercial gas production.

In the north, deep drilling, in the last few years, has opened up a wealth of gas reserves of which very little is known except their probable tremendous size. The development of gas and, later, oil at Rodessa led to a revival of deep prospecting and carried the wildcatters into the formerly "blind area," the north central basin between the Sabine Uplift and the Monroe Field. The search for oil, besides opening up the Lisbon Oil Field, found oil in deeper sands in the Sugar Creek Field, and gas farther out in the basin in the Simmsboro, Driscoll, and Bear Creek Fields. All of these fields yield a gas extremely rich in recoverable fluids. Because no adequate gas market has been developed for the new fields, only two or three wells have been drilled in each, and no definite opinion can safely be formed on their extent.

In the Sabine Uplift Area tremendous gas reserves in the Trinity group have been opened up in Rodessa, Cotton Valley, Sligo, Blanchard, Dubberly (Sibley), and Lake Bistineau. Strong indications of similar gas production in the deeper sands have been found in the Converse, Zwolle and Shongaloo fields. These deep gas reserves, all more or less similar in nature, are sufficient in volume to justify major expansion in gas pipe line outlets from the state, and to assure an ample supply for any future industrial expansion within the state.

Photo courtesy The Barrett Company

Southern Natural Gas. Co. coated 12 inch pipe line in sand on Louisiana side of Mississippi River crossing.

Considerable time and effort is now being devoted to the search for some outlet for the new fields. Though the fluid content of the yield from the new wells is sufficient to justify hope of satisfactory returns from recycling operations, pressures are uniformly too high for economic operation using absorption methods for stripping. Recent developments in stripping methods depending for their success on temperature and pressure changes, rather than on mineral seal oil absorption, methods that permit of economical operation at very high pressures, give strength to the hope that the near future will find in recycling a solution for the problems in the new deep fields.

More remote, probably, than recycling, but still within reasonable hope of attainment, is the possible future market for gas in the manufacture of gasoline. Polymerization of methane and ethane, now purely a laboratory operation because of the extremely high temperatures and pressures required for stabilization, has reached the point where reduction of the necessary pressures and temperatures to within the range of economic operation depends only on the discovery of a suitable catalytic agent.

With reasonably adequate laws and reasonable enforcement, with the realization of its tremendous responsibility as the custodian of one of the nation's greatest fuel reserves, Louisiana looks forward with confidence to the future. Already, during the past year, industrial expansion has shown remarkable development within the state. Louisiana believes in the conservation of natural gas, and defines conservation as intelligent use.

Louisiana Natural Gas Production by Principal Fields in Thousands of Cubic Feet. 1927-37.

	1927 and prior years	1927	1928	1929	1930	1931
Monroe	728,232,806	132,895,666	157,561,267	170,570,430	142,401,460	103,178,400
Richland	1,838,354	1,837,404	9,916,625	42,017,061	86,135,483	90,485,950
Elm Grove	146,726,056	7,598,818	12,071,756	13,995,682	12,297,167	10,018,739
Rodessa	....	....	....	....	....	227,670
Caddo-Pine Island	115,093,818	11,956,293	4,673,866	2,156,587	3,549,930	2,170,443
Cotton Valley	12,824,841	5,341,222	13,461,448	18,584,612	13,508,953	4,103,990
Shongaloo	46,560,778	10,409,651	13,238,825	5,468,375	2,019,884	1,202,415
Bull Bayou	42,289,557	2,182,354	2,744,896	3,258,036	2,525,622	1,838,035
Sugar Creek	....	....	....	....	....	3,801,906
Springhill-Sarepta	17,276,098	4,119,347	4,253,038	2,641,104	455,259	347,061
Waskom Bethany	4,506,754	2,047,307	3,051,318	1,576,143	1,208,957	1,389,303
Total	1,123,508,222	181,169,793	232,820,319	262,680,782	266,380,184	222,471,691

	1932	1933	1934	1935	1936	1937	1937 and prior years
Monroe	95,853,790	113,424,295	163,376,378	181,698,039	205,251,588	197,992,348	2,259.540,801
Richland	81,163,374	56,449,102	32,373,118	21,450,393	12,218,415	8,283,967	442,331,843
Elm Grove	2,308,171	2,252,053	2,588,649	2,137,970	1,925,434	1,497,448	207,819,125
Rodessa	1,383,120	7,784,211	13,934,264	22,346,119	42,411,550	56,338,906	144,425,840
Caddo-Pine Island	1,272,959	1,198,276	1,138,747	1,293,991	1,527,978	1,157,342	135,233,937
Cotton Valley	2,725,598	2,149,976	1,963,838	1,767,971	2,057,455	10,400,887	83,549,569
Shongaloo	920,942	753,132	384,531	151,029	146,678	148,974	70,995,564
Bull Bayou	1,670,150	3,071,266	1,467,928	1,266,636	1,323,610	1,135,423	62,591,159
Sligo	....	....	3,952,601	4,910,034	8,756,643	13,826,969	31,446,247
Sugar Creek	3,958,095	3,695,232	4,245,021	5,715,861	5,466,001	4,534,001	31,416,117
Springhill-Sarepta	306,694	160,927	48,220	34,703	23,985	21,702	25,568,791
Waskom Bethany	1,768,245	1,500,679	1,049,636	841,478	453,740	272,975	15,571,921
Total	198,694,147	193,202,645	230,292,473	253,174,592	283,813,709	301,147,717	3,532,770,955*

Source: Louisiana Department of Conservation.

* This figure includes all metered gas produced in Louisiana prior to 1937; 3,510,490,914,000 cubic feet of gas have been produced from these twelve fields; and 22,280,041,000 cubic feet of gas have been produced from other fields in Louisiana not listed in this table.

Spanish moss, the "lagniappe" crop of South Louisiana, is widely used in the upholstery of furniture and for other manufacturing purposes. The value of the crop is estimated at 1½ to 3 million dollars annually.

What Palms Grow In Louisiana

By

MIRIAM L. BOMHARD

PART III*

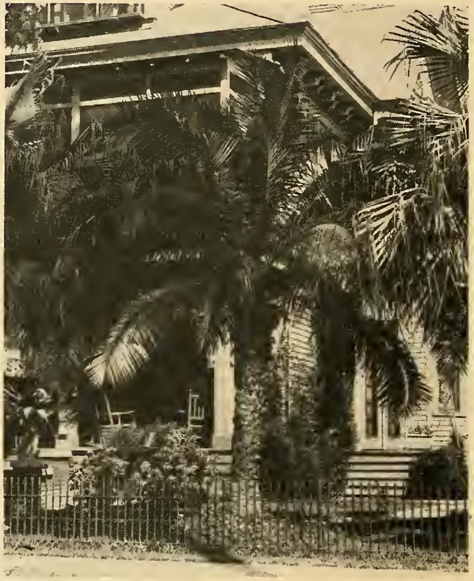


Fig. 20. Cliff date palm (P. RUPICOLA). 905 Nashville Avenue, New Orleans.

P. Dactylifera Linn.

Date palm, edible date palm[1]

Dactylifera, meaning "finger-bearing", clearly refers to the fingerlike appearance of hanging clusters of date fruits. This species is one of the oldest of cultivated plants. Its native home is not known to this day; it is thought that it once grew wild along ravines bordering deserts in Arabia or Africa. The cultivation of the date palm is the major enterprise of Arab populations in desert regions of northern Africa and Arabia, whence come the dates of commerce. In these regions, date palms also provide most of the necessities of life for both man and beast.

Missionaries, accompanying the early Spaniards, probably first introduced this palm to our continent, where it has become naturalized. Besides, many plants have, no doubt, grown from commercial date seeds which happened to find a suitable habitat. Successful date culture in the arid Southwest had its origin with the importation of offshoots of choice Old World varieties into California and Arizona, about 1900.

Given an almost constant supply of water at its roots, the date palm thrives in the hottest and driest climate and the older plants will even endure occasional freezing periods, if not too prolonged. However, this species is able to grow in many regions, such as ours, which are too humid to ripen the dates successfully on a commercial scale. There are many more date palms in Louisiana than is generally supposed. It is not uncommon to see fine old date trees in southern Louisiana far removed from any habitation, showing that they have existed for many years. In the older sections of New Orleans, isolated specimens occur in a great many gardens. Many of these trees produce fruits of good flavor.

The development of offshoots on the parent trunk is characteristic and continues until the plants are from 10 to 15 years old. By far the greatest number of these palms in Louisiana have a single trunk; it is usually possible to see where the offshoots have been removed. There are two specimens in Audubon Park, New Orleans, which are excellent horticultural examples of date palms with several trunks (Fig. 10). When all the offshoots are permitted to grow, very dense, spiny, unattractive clumps result. In cultivation, it is customary to trim off the dead leaves; otherwise, they would hang on for years. Fig. 15 shows the neat arrangement of thin, appressed boots, surrounded by fibrous sheaths; in older trees, this effect can be seen high upon the trunk just beneath the crown. On the whole, the trunks of older date palms are not very attractive and the base is covered with a mass of roots.

Date palms grow to 100 feet in height. The crown of grayish green leaves, averaging 12 to 14 feet in length, is very distinctive (Fig. 16). It looks sparse, mainly because (1) the upper leaves stand nearly erect; (2) the segments are stiff and point upward at an acute angle; and (3) the petiole occupies fully 1/4th to

---

[1] *P. dactylifera* is usually referred to simply as "date palm". The prefix, "edible" has been used in this article wherever it was necessary to avoid confusion.

* Note: Reference should be made to Parts I and II (Autumn and Winter issues) for explanation of technical terms used in the discussions of genera and species for Figs. 1 to 17.

1/5th of the total leaf length, making an "open" crown. Fig. 17 shows the arrangement of the spines.

Artificial pollination of date palms began 3,000 or 4,000 years ago. The Assyrians may have been the first to originate the method, still in use in the Old World, of tying a few male flower branches in the midst of the female spadix to insure the setting of good fruits, rather than trust to the wind to carry the pollen. Collecting the pollen from male trees and spraying it on the female flowers is the improved practice. Date palms may begin bearing when several years old and continue for 100 to 200 years. There are several hundred named varieties, differing in the shape, size, and quality of the dates. Date fruits are from 1 to 3 inches long and vary in color from tones of yellow and brown to red or black; each contains a single seed. These palms are easily cultivated from seeds, but, in commercial plantings, it is best to set out offshoots of the female trees. There is too much variation in seedlings; besides, there is an even chance that half will be males. It is a waste of space to grow more than a few male trees to pollinate the entire orchard.

If properly pollinated, 2 of the 3 carpels of the female flower soon drop off and only one matures. Otherwise—and this is frequently true of date palms planted for ornament—all 3 carpels develop. The dates are then smaller, usually seedless, and not of normal cylindric shape. Sometimes, they are seedless even when only one carpel ripens. Such a tree in New Orleans (on Chestnut, near Eighth) bears luscious black dates, over 1-1/2 inches long, which are nearly or quite seedless; they ripen in October and November. According to Mr. Chopin, who has frequently called attention to this palm, it was planted from seed about 48 years ago.

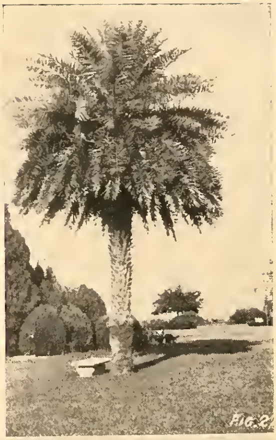
P. Reclinata Jacq.

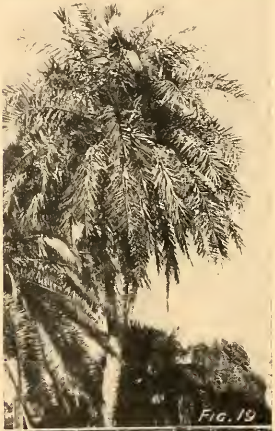
(P. spinosa, P. leonensis, P. senegalensis). Senegal date palm.

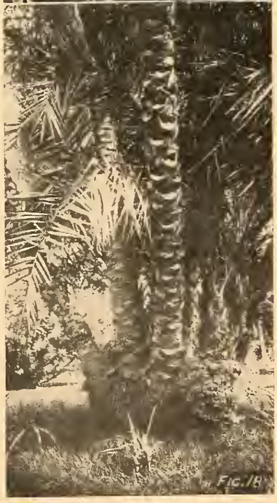
The reclined or curving attitude of the leaves is reflected in the specific name, *reclinata;* however, several other species of *Phoenix* have decurved leaves. This palm is widely distributed in tropical and subtropical Africa, exhibiting, according to the late Dr. Beccari, eminent palm student, considerable natural variation because of adaptation to diverse climatic and soil conditions. The plants known as *P. spinosa,* are to be referred to *P. reclinata,* although this disposition is not very satisfactory from a horticultural standpoint.[2] However, the Senegal date palm is not well understood and the variation in cultivated specimens which bear this name is nothing short of bewildering, including types with short, smooth, glossy leaves and very slender trunks as well as dense clumps with thicker trunks and spiny leaves.

Fortunately, the New Orleans specimens—I have not found this palm elsewhere in Louisiana—resemble each other fairly closely and the following description applies only to these. The finest example (Fig. 18) is an open-grown, massive palm, composed of 10 trunks, of which the tallest measures over 20 feet in height and 10 inches in diameter. The leaf-scars, appearing as if halfmoon-shaped "bites" had been taken out of the trunk, are characteristic of our specimens. In fact, I have found the form of the scar useful in recognizing other types of *reclinata* outside of Louisiana; naturally, the size and depth of the scar varies with the size and shape of the petiole.

Fig. 22 (top)—India date palm (P. SYLVESTRIS). Open-grown, robust specimen. Note very dense crown; also characteristic root area on lower portion of trunk. West End Park, New Orleans. Fig. 19 (center)—Crown of Senegal date palm (P. RECLINATA). Single-trunked specimen on City Park Avenue (Newsham's floral shop), New Orleans. Canary Island date palm to left. Fig. 18 (bottom)—Base of Senegal date palm (P. RECLINATA) with 10 trunks. Note characteristic leaf-scars on trunk in foreground. St. Charles Avenue, New Orleans.







Our specimens have a rather dense crown of deep green (slightly bluish) leaves, which arise at an angle and then curve over gracefully. The crown is rather soft and appears "leafy", because the rather broad

---

[2] Taxonomically, there is an agreement in that the male flowers of both have narrow, long-pointed petals with an irregularly toothed margin, which is quite different from all other species of *Phoenix*.

segments are flattened, of about equal length (20 to 24 inches), and stand out at various angles almost the entire length of the leaf. Actually, the segments are slender-pointed, but hardly spine-tipped, and distinctly bunched in 3's and 2's (the pairs often being nearly in 4's in the lower portion of the leaf) with definite spaces between the groups. The slender, green (sometime orange-tipped) spines also occur mainly in pairs. The petiole, though slender, is rather thick for its width and narrows abruptly where the true segments begin. The female spadix is rather short and sparsely branched. Our specimens do not bear typical fruits, apparently being pollinated by the Canary Island date palm.

The only other species which suckers is *P. dactylifera*, but it can not possibly be mistaken for *reclinata*. Compare Figs. 16 and 19. However, some mention of crossing between them is made under the paragraph on hybrids. The male trees of the Senegal palm have recently become commercially important in California because their pollen, placed on the female flowers of *dactylifera*, causes the dates to ripen later, which is very desirable. A male tree, bearing typical flowers, may be seen in New Orleans on St. Charles Avenue, near Third.[3]

R. Rupicola T. Anders.

Cliff date palm.

Rupicola means "growing among rocks" and refers to the typical habitat of this palm. It is a native of northeastern India, existing from 400 to 1,400 feet above sealevel. Since it naturally grows in a humid region in a climate warmer than that of Louisiana, it is not a hardy palm, and one would not expect to find a specimen 20 feet tall in New Orleans (Fig. 20). If my information is correct, this is the only cliff date palm growing outdoors in the entire State at the present time. There was another, about 10 feet tall, which was removed a few years ago.

This species combines grace and elegance in a palm of medium stature. The beauty of its foliage surpasses that of all the other *Phoenix* species. The leaves, rounded at the tip, are dark, glossy green, with all the soft flat segments singly placed and lying directly opposite each other in the same plane; they measure 10 feet in length and 2-1/2 feet across in the widest part. Ascending at first, the leaves then swing outwards and downwards, arching gracefully, and at the same time turn through an angle of 45° to hang edgewise. The true segments immediately follow the last of the short, needle-like spines, with no transition between.

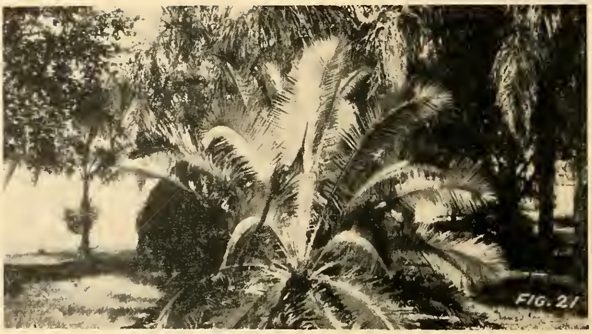


Fig. 21. Young cliff date palm (P. RUBICOLA). Winter Haven, Florida.

There is an interesting history connected with the Nashville Avenue palm. It was a wedding present and had been kept as a pot plant for years; finally, because of its size, it was planted outdoors. The present owner, Mr. George R. Thompson, tells me that he had taken the precaution of wrapping blankets around the upper part of the trunk to protect the bud. This palm is now about 33 years old. It bears fruits annually but they are pollinated by some other date palm species. Young plants of this species are particularly lovely (Fig. 21). All palms are more tender during their early years; especial care would have to be taken of this species, but its beauty would probably repay one for the effort.

P. Sylvestris Roxbg.

India date palm, wild date palm.

The specific name, *sylvestris*, means "of the woods or forests". This palm is found native or in cultivation through much of India and in some places forms extensive forests. It may grow in mountainous regions up to 5,000 feet altitude, on the plains, and along river courses in drier areas. It is an important tree in many localities, being extensively cultivated for its sap, used in the making of sugar. After the plants are about 5 years old, they are suitable for tapping.

The India date palm always has a single, comparatively slender trunk, up to 50 feet in height, which retains the leafbases. The bulged, shieldlike bases of the petioles, separated by the several ridges of the leafsheath scars, and the ever-present mass of roots, extending 3 feet and more up the trunk, are characteristic of this species. The crown is very dense, rounded or pyramidal, with the stiffish, grayish green leaves curved somewhat at the tips. The petiole occupies only about one foot out of the total leaf length of 10 to 15 feet. The firm segments, standing at various angles, remain more or less folded to their stiff, pointed ends. The yellow fruits, although fleshy, are very astringent and seldom used for food, even by natives.

Fig. 22 shows the heavier crown and more robust habit of an open-grown tree; a taller, more slender and typical specimen is illustrated in Fig. 23. (Unfortunately, the crown in this photograph appears sparser than usual because the trees had recently been trimmed). The four specimens in Colonel Derby's garden have been pronounced by an expert on *Phoenix*, to be perhaps the finest to be seen anywhere in the United States. Colonel Derby planted them about 1906. There are, on the whole, a fairly large number of India date palms in neutral grounds and parks and therefore open-grown, in Louisiana (mainly in New Orleans). Many are true *sylvestris*, but many others show some characters of *canariensis* or *dactylifera*.

---

[3] Near Scheinuk's floral shop.

This species is quite as hardy as the Canary Island palm; it grows faster and does not occupy as much space. It is surprising that it is not more widely planted.

Phoenix Hybrids.

Date palms which are not typical.

The purpose of this paragraph is to point out that many date palms in cultivation are not typical, frequently showing mixtures of the characters of 2 or 3 species; sometimes the parent species can not even be guessed at with any degree of certainty. Planting the seeds of these palms of mixed heritage only adds to the confusion. As was pointed out elsewhere, the male and female trees of any one species do not always flower at the same time. The pollen of any date palm, blown by the wind, may pollinate the female flowers of almost any other date palm. It is best to plant seeds or set out seedlings obtained from a reliable source; many nurserymen import seeds gathered from the species in its native home.

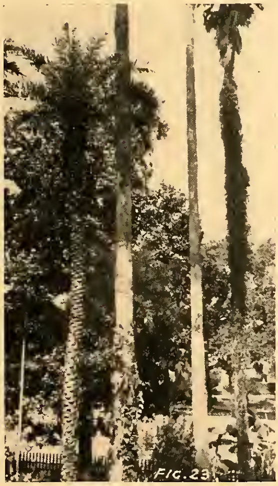


FIG. 23

Fig. 23. Senegal date palm (P. SYLVESTRIS). One of 4 very typical specimens in the garden of Col. Derby, Carrollton Avenue, New Orleans, growing with the Mexican Washingtonia (WASHINGTONIA ROBUSTA).

There are massive date palm clumps to be seen here and there, which are not true *dactylifera* nor true *reclinata* but the very fact that they are composed of several stems indicates that one or the other of these species is involved in the parentage. Most of these clumps are practically impossible to classify precisely.

A familiarity with the characteristics of *canariensis, sylvestris*, and *dactylifera* often makes it possible for even an inexperienced observer to recognize which ones were the parents of a hybrid tree. Sometimes—and there are several avenues of such specimens in New Orleans—it is known that there has been a mixture of all 3 species in varying proportions; these palms are quite recognizable as being "different" and unlike any of the 5 species of *Phoenix* described in this article.

The Spawning Habits of Fish

The spawning habits of fish divide them into two classes. The first class includes the so-called more primitive type of fish. They usually deposit a large number of eggs and then leave the incubation, hatching and care of the young fry to chance. Examples of fish that have such spawning habits are paddle fish, sturgeon, gar, carp and many other of the larger fish.

An exception to such classicial examples that have similar habits in this group, are yellow perch and the "wall-eyes". These random spawners scatter their eggs in clumps over a rather large area, either on rocky and gravelly bottoms where insect larvae may be abundant food for the young fish when they emerge, or the eggs may be scattered in shallow water among the aquatic plants where certain minute animals or plants will exist in sufficient quantities to supply the young fish with food, as many young fish eat plant material. Some young fish feed, from the beginning, on animal life.

The amount of eggs deposited by fish will depend upon the size of the fish. A five-pound female carp will deposit nearly five hundred thousand eggs during the spawning season. Wall-eyed pike will deposit from fifty thousand to as high as three hundred thousand, the number, of course, depending upon the size of the female. Sturgeon may lay many more than this as these fish grow to great size.

The second group of fish have more methodical spawning habits and build nests that are hollow-like craters in the silt or gravel bottom of the pond or lake. Here the eggs are deposited by the female and fertilized by the male, and then carefully guarded usually by the male, until after hatching. The nest building habits are typical of the basses, crappie and sunfishes.

Either the small-mouth or large-mouth black bass will deposit from fifteen hundred to as high as ten thousand eggs; the usual average runs from thirty-five hundred to five thousand. Here again the number of eggs deposited depends upon the size of the female. Bluegill will run a higher average than the basses—from five to ten thousand. This is also true of the crappie.

Some of the minnows carefully fasten their eggs to the underside of floating vegetation, sticks, or stones that may be in the water. These fish naturally are not as prolific as large fish. These masses of eggs will run from two hundred to four or five hundred eggs in each place.

Some of the fish that live in swiftly moving streams deposit their eggs in loose gravel and then cover them lightly with coarse gravel and sand to protect them from predators and keep them from washing away. Such fish, of course, do not deposit many eggs and it is probable that no parental care is given to the eggs once they have been covered.

The eggs of fish are, of course, living things and must have suffi-

(Turn to Page 57)

Recent Trends in the Legal Control of Ground-Water Resources

By
DAVID G. THOMPSON and
ALBERT G. FIEDLER[*]

During the past few years, there has been an increasing interest in problems that relate to the legal control of ground water in order to conserve the natural supply.

It is the purpose of the present paper to consider the problem of legal control particularly as it arises in areas where the use of ground water for public supply or industrial purposes is predominant.

Some Fundamental Principles Of Ground-Water Hydrology

It is first desirable to state briefly some fundamental principles that govern the occurrence and recovery of ground-water and which should be thoroughly understood and recognized in any attempt to develop a sound doctrine of control of ground-water.

When water is drawn from a well, either by pumping or by natural artesian flow, the head of the water immediately drops in the well and also in the formation surrounding it. It has become increasingly clear in the past few years that eventually the area of influence of a pumped or flowing well may expand to great distances.[1]

Long time observations in a few parts of the country have shown considerable decline of the water table or artesian pressure. Such decline suggests, but does not necessarily prove, that the draft of the water-bearing formations has been in excess of average annual recharge[2] According to the principles of hydraulics involved, it is necessary to lower the head on the water—that is, to produce a drawdown—in order to cause the water to flow toward the well from which it is being withdrawn. Therefore under some conditions a considerable drop in head when water is withdrawn from a formation is no more serious than the drop in head experienced at times of peak load in a water distribution system which has an adequate supply available; and this fact must be recognized in any program of legal control that is to be fair to all users of ground-water. Also it must be recognized that, generally, it is impossible for one land owner to pump water from beneath his land at an appreciable rate without affecting the water level or artesian pressure beneath the land of his neighbors and perhaps also beneath land at a distance of several miles from his own property. Thus, for example, within the past year it has been demonstrated beyond any reasonable doubt that a group of wells pumping about 7 million gallons a day from the Lloyd sand on western Long Island has produced measurable changes in head of the water level in observation wells located at least 7 miles from the nearest pumping well, and there is some evidence to suggest that the effect has extended to a distance of at least 12 miles.[3] However, this widespread effect does not necessarily indicate overdraft.

An important consideration is that, with minor exceptions, the water that a person pumps from his well is actually not a permanent part of his land, but, like the wind that passes over it, moves from beneath the land of another to his land and passes on to more distant points.

In many parts of the country enough water can be obtained for an industrial enterprise or a public supply only by taking water that would theoretically belong to numerous individual land owners if each should demand his share.

We have emphasized these general hydrologic facts because we believe that the present unsatisfactory situation in regard to legal control of ground water is the result of inadequate knowledge or incorrect interpretation of certain natural laws and observed hydrologic conditions; that this situation has been perpetuated because stress has been laid on factors which, although perhaps once important, are now seen to be not nearly as important or applicable as some other things.

Doctrines of Ground-Water Law—The English Doctrine

The oldest modern doctrine with respect to rights in the use of ground water is generally known as the common law or English doctrine.

Under this doctrine the owner of land may utilize the water beneath his land in any way that he wishes. He may pump as much as he wishes even though he deprives his neighbor of water. Obviously this doctrine offers no possibility of any control to prevent overdraft of a ground water reservoir.

---

[*] A paper presented at the convention of the American Water Works Association, held in New Orleans, La., April 24-28, 1938: Reproduced herewith by permission of the Director, Geological Survey, U. S.. Department of The Interior and of the editor of the Journal of the American Water Works Association

[1] Theis, C. V., The nature and significance of the cone of depression in ground-water bodies: (Abstract) Economic Geology, vol. 32, p. 1079, December, 1937.

[2] See for example Ebert, F. C., An interpretation of water table fluctuations of four wells in southern California: Transactions American Geophy. Union, 17th Ann. Meeting, part II, 1936, pp. 376-377. This paper was part of a symposium on fluctuations of ground-water levels which contains graphs showing the long time record of ground-water fluctuations in wells in several different parts of the United States.

[3] Leggette, R. M., The mutual interference of artesian wells on Long Island, N. Y.: Trans. of the Amer. Geo. Union, 18th Ann. Meet., Part II, pp. 490-494, 1937, and subsequent unpublished observations.

The old English doctrine was reaffirmed in England as late as 1932. It has been recognized in many States in this country and was reaffirmed in Vermont as late as 1930.[4] It is noteworthy, however, that English water works engineers have felt that this rule does not sufficiently safe guard the interests of owners of existing wells, and especially of public water supply developments and efforts have recently been made to modify the old English doctrine.[5]

The "American" Doctrine Or Doctrine of Reasonable Use

In 1862 the Supreme Court of New Hampshire, in the case of Bassett v. Salisbury Mfg. Co.,[6] departed from the English doctrine and set up what is known as the American doctrine or doctrine of reasonable use. This holds that a man's right to take percolating water from beneath his own land is limited by the corresponding right of his neightbor, and "restricts each to a reasonable exercise of his own right, a reasonable use of his own property, in view of the similar rights of others".

The doctrine of reasonable use has been recognized in a number of states. In actual practice it has been applied principally in cases where water was transported from the lands from beneath which it was obtained and used on distant lands, generally by sale by public supply systems. Such transport for sale has been considered an unreasonable use; and certain municipalities have been forced to pay damages to owners of lands directly overlying the water-bearing formations.

Doctrine of Correlative Rights

In 1903 the doctrine of reasonable use was extended to California in the case of Katz vs. Walkinshaw, in which the principle issue was use of water on lands distant from its source.

However, in this case the California court introduced a further development of the doctrine of "reasonable use" by stating, apparently purely as **dictum** what has become known as the doctrine of "correlative rights". The court said:

> "Disputes between overlying land owners concerning water for use on the land, to which they have an equal right, in cases where the supply is insufficient for all, are to be settled by giving to each a just and fair proportion."

This is the basis of the doctrine of correlative rights. It should be noted, however, that in the case of Katz v. Walkinshaw, the court did not state definitely that there could be no priority of right among owners of lands who possessed such correlative rights.

Much might be said in regard to the doctrines of reasonable use and correlative rights, but space does not permit. It will suffice to say that, in a large majority of the cases, the principle point under consideration has been the question of whether it was proper to transport water from wells to parcels of land that were distant from the land overlying the water-bearing formation. Actually, there have been few decisions where correlative rights were involved as the principle issue. The present writers know of no instance in any State following the doctrine of correlative rights where the doctrine has been applied to adjudicate and divide the water of any large ground-water basin among any and all land owners.

The California Constitutional Amendment

On November 6, 1928, there was adopted an amendment to the constitution of the State of California which emphasized the fact that the right to use water should depend upon a reasonable use or reasonable method of use or reasonable method of diversion of the water.

Since the adoption of this amendment the California Supreme Court has in at least two cases relating to riparian rights decided that certain uses or methods of use were unreasonable which previously in a long series of cases had been held to be reasonable.

This stricter interpretation of "reasonable use" may eventually prove of value in subsequent attempts to regulate use of ground water as suggested in a later page.

However, in summarizing the effect of the doctrines of reasonable use and correlative rights as applied in both the eastern and western parts of the United States, the following statements seem to be proper: first, the doctrines have been observed more often in their non-application than in their application; second, the usefulness of the doctrines has been essentially nullified by this general non-application; third, generally the situation has been much as it would have been under the English rule, in that each land owner has installed as deep a well and as large a pump as he wished and has pumped about as much water as he had use for; and, fourth, there is nothing to encourage a belief that the doctrines can be made any more effective in the future than in the past in limiting the consumption of ground water in areas where the present actual consumption or anticipated consumption may exceed the safe yield of the water-bearing beds.

The Doctrine of Appropriation

In the arid and semi-arid States appropriations of both surface and ground water are generally possible.

The doctrine of prior appropriation rests upon the premise that the water belongs to the State as representing the public. The granting of an appropriation confers no right of ownership but only the right of use, and the exercise of that right is only a valid license for use only as long as such use is for beneficial purposes.

The United States, by a law passed in 1866 (Sec. 2239, Revised Statutes of the United States, U. S. Comp. St. 1901, p. 1437) provided for the appropriation of water on public lands, and this recognition of the doctrine of appropriation has been upheld by several decisions of the Supreme Court of the United States.

The Oregon Statutes of 1909 specified that all waters within the State may be appropriated for beneficial use, but it was not until 1927 that appropriation was specifically applied to ground waters in the arid part of the State. (Chapter 410, General Laws of Oregon, 1927, approved March 3, 1927).

---

[4] Fire Dist. No. 1 v. Graniteville Spring Water Co. (Nov. 5, 1930).

[5] Gourley, Harold J. F., Some recent developments in British water works practice: New England Water Works Assoc. Jour., vol. 50, p. 346-348, 1936; excerpts of the same article are published in Water Works Engineering, vol. 89, pp. 1294, 1295, 1936; and in Water and Water Engineering (London), vol. 39, pp. 45-48, 1937. The article states that representations having been made to the Ministry of Health in regard to this problem by several associations of water works and other engineers and having received favorable action by that ministry, the matter has been under consideration by a joint committee of both Houses of Parliament.

[6] 43 N. H. 573; 82 Am. Dec. 180, The facts in the case are stated in an earlier decision on the same case in 28 N. H. (1849).

The most notable advance in adopting the appropriative doctrine occurred in New Mexico in 1931 when a statute was passed declaring underground waters subject to appropriation. The doctrine of appropriation was also adopted in Utah by a law passed in 1935.

The further extension of this doctrine of appropriation, particularly in western States, is suggested by the action of a committee of the Association of Western State Engineers in proposing a "uniform underground water law for western States,[7] which in many respects is patterned after the New Mexico law.

Attempts at Legal Control In the Eastern States

Coming back to the eastern part of the country, in New Jersey there has been a partial control of the ground water by the State since 1910, and a somewhat similar control in New York since a more recent date. In each State the control is through laws which provide that new or additional developments of either surface or underground water, for public supply, by municipalities or privately owned water-supply companies, cannot be made until the controlling State commission has approved the plan for such development. Favorable action by the controlling commission apparently does not establish a grant of any right to use the water, but is primarily an approval of plans.[8]

In this connection it is worthy of note, that in 1931 the city of East Orange was required to pay damages to an owner of land overlying the water-bearing beds[9] in spite of the fact that the application of the city to divert ground water had been approved by the Water Policy Commission. Nevertheless, the laws in both New Jersey and New York have had some effect in controlling the use of ground water in that the controlling commissions have refused to approve some developments for public supply. On the other hand, after a municipal development has been approved by the State and has been completed, perhaps at considerable expense, there is nothing to prevent a private development being made which may greatly reduce the capacity of the wells of the public system or perhaps even destroy its usefulness.

The New York "Police Power" Law of 1933

In 1933 the New York Legislature amended the laws relating to powers of the State Water Power and Control Commission, to provide that no person, firm or corporation shall hereafter install or operate any new or additional wells in the four counties that comprise Long Island to take ground water for manufacturing or industrial purposes where the capacity of such wells singly or in the aggregate is in excess of 100,000 gallons a day without first obtaining the approval of the commission.

The first section, after referring to investigations "which indicate that the depletion of underground waters under Long Island is such as to threaten the adequacy of water supply for domestic consumption of the inhabitants thereof," states that "this enactment is made in the exercise of the police power of the State and its purposes generally are to protect the public health, and public welfare in conserving the supply of water for domestic consumption."

This is, so far as the present writers are aware, the first instance in which the police power of the State has been openly invoked to give to a State regulative body the power to control the withdrawal of underground water.

The New York law of 1933 undoubtedly has had beneficial results. It was enacted near the beginning of the veritable wave of development of ground water for air-conditioning. Russell Suter, Executive Engineer of the New York Water Power and Control Commission, has informed the writers that since the passage of the bill there have been more than 300 applications for approval of wells, of which 204 were to be used for air-conditioning. Approval for these has been granted only on condition that the water be returned to the ground through so-called "diffusion wells." The quantity of water involved in the applications related to air-conditioning is estimated at 2½ billion gallons per year (averaging about 7 million gallons a day) and a smaller quantity for about 40 other industrial wells involving several million gallons a day. Although the total quantity of water is not great as compared to the vast quantity of water taken from wells in the western part of Long Island, nevertheless the restriction put on the use of the water has undoubtedly helped to retard the advent of serious results, particularly the intrusion of salt water, in an area where the supply is obviously already badly overdrawn.[10] The writers wish to suggest—and perhaps the same thought has occurred to others—that in view of the recent interpretations of the term "reasonable use", "reasonable method of use", etc. in the California cases decided since the amendment to the constitution of that State, it might well be argued that the use of a large quantity of ground water as the cooling agent for air-conditioning is an unreasonable use, in view of the fact that the same results may be accomplished by other methods, which do not use so much water. There may be some question as to whether such an argument would be effective as applying to a factory, in Brooklyn for example, for use of ground water in making soap, or paper or in some other process in which there could be no substitute for the water and in which the water would be so polluted by trade waste that it could not be turned back into the ground.

The 1933 law gives to the Water Power and Control Commission jurisdiction over wells having a capacity of more than 100,000 gallons per day, which is roughly 70 gallons per minute. If one well should be put down in each block in the most thickly populated or heavily industrialized sections of Brooklyn and pumped at just the legal limit of 100,000 gallons a day, the total pumpage from such wells on a square mile would be about 10 million gallons per day, which is several times the rate of recharge of the water-bearing beds. This figure may not be entirely fantastic now that restaurants, "movies", department stores, and other stores must be air-conditioned if they are to hold their share of business. It would seem that if any law similar to that now operative on Long Island is to be thoroughly effective in any locality, the limit of pumpage beyond which a well would come under jurisdiction of the law should be considerably below that stated in the New York law, and in fact at least as low as the rate of average annual recharge. In this connection it is worthwhile to point out that on Long Island, if the water were divided equally among all lands in proportion to their area and to the estimated safe yield of the water-bearing sands, each city block would be entitled to only about 10,000 gallons a day (7 gallons a minute). In many other parts of the country the average rate of recharge would be much less.

---

[7] Proceedings, Seventh Ann. Conference, Assoc. of Western State Engrs., p. 45, 1934. This proposed law is also published as Appendix XV of "The future of the Great Plains: Message of the President of the United States, transmitting the report of the Great Plains Committee": House Document no. 144, 75th Congress, 1st session, 1937.

[8] Chapter 304, P. L. 1910, p. 551; Chapter 267, P. L. 1929, p. 631.

[9] Braidburn Realty Corp., et al. v. City of East Orange, 107 N. J. L. 291, 153 Atl. 714 (1931).

[10] Lease, W. F., Some surface water supply of western Long Island and its utilization: The Municipal Engineer's Journal, First Quarterly Issue, pp. 26-27 and accompanying map: 1934; Suter, Russell, Water supplies of Long Island: New York Department of Conservation Water Power and Control Commission Bul. GW-2, 1937, pp. 47-51 and Fig. 26.

Possibilities for Future Legislation

Conditions could be cited in a number of States where it is exceedingly desirable that there be some limitation placed on consumption before a valuable natural resource is largely destroyed. It appears that the doctrines of reasonable use and correlative rights, at least as recognized thus far, do not afford any hope of bringing about the desired control. The question arises as to whether any effective measures can be taken. It has become the conviction of an increasing number of engineers and geologists that the doctrine of appropriation, properly applied, offers the only satisfactory answer.

The hesitancy to attempt to introduce the doctrine of appropriation of ground water in the eastern States has been due perhaps in part to the fact that in certain court decisions it was considered there was a difference between eastern and western conditions; that water has greater value in the West than in the East. This is, however, no longer a valid argument, in view of our present knowledge of the limitations of water supply in eastern areas.

In some western States the inauguration of the doctrine of appropriation has been facilitated by the fact that the State constitutions carry a clause stating, in effect, that all waters in the State belong to the public or that the waters are subject to appropriation, or some other statement by which the public ownership of the water is declared.

Unfortunately, the constitutions of most of the States, are entirely silent as to water rights. In such States there is the possibility of amending the constitution to specifically provide for appropriation of either surface or ground water. The question may also be raised as to whether it may be possible to bring about appropriation of water without a declaration of the doctrine in the State constitution.

The paramount argument likely to be raised against the adoption of the doctrine of appropriation is that it would violate that part of the 14th Amendment of the Constitution of the United States which says that no State shall "deprive any person of life, liberty, or property without due process of law, ***". As a matter of fact, the Supreme Court of the United States has handed down a number of decisions which have interpreted the application of the 14th Amendment in such a way as to give a reasonable hope that it would not look upon the adoption of the doctrine of appropriation as the taking of property without due process of law.

In 1905 the State of New Jersey passed a law (Chap. 238, Laws of New Jersey of 1905) which prohibited the transportation of water into another State. In upholding this law the Federal Supreme Court emphasized the right of the State to pass the law in the exercise of its police power.

The decision, (Hudson County Water Co. v. McCarter, Attorney General of the State of New Jersey, 209 U. S. 349 (1908) written by Justice Oliver Wendell Holmes, said in part:

> "*** Few public interests are more obvious, indisputable, and independent of particular theory than the interest of the public of a State to maintain the rivers that are within it substantially undiminished, except by such draft upon them as the guardian of the public welfare may permit for the purpose of turning them to a more perfect use. This public interest is omnipresent wherever there is a State and grows more pressing as population grows. It is fundamental and we are of the opinion that the private property of riparian owners cannot be supposed to have deeper roots. ***"

In another decision of the Supreme Court, that of Trenton v. New Jersey (262, U. S. 182, 1923), it was stated:

> "The State undoubtedly has power, and it is its duty, to control and conserve the use of its water resources for the benefit of all its inhabitants***"

For many years there has been some abridgment of property rights through the enactment of State laws based upon the police powers of the State. Originally the exercise of the police power seems to have been justified from the standpoint of protecting the public health, the public morals, or the public safety. However, as long ago as 1906 the Federal Supreme Court (in the case of C. B. and Q. Ry. v. Illinois, 200 U. S. 561, 26 S. Ct. 341) has also said that "the police power of a State embraces regulations designed to promote the public convenience or the general prosperity".

C. M. Niesen,[11] considering the question of the constitutionality of an Oregon law which restricted the rights of riparian owners in favor of the doctrine of appropriation has stated: "the United States Supreme Court will probably sustain legislation like the Oregon statute when the issue is squarely presented since (1) the public interest in the conservation and economic use of a limited water supply furnishes a valid object for the exercise of the State police power, and (2) the statute limiting the right of riparian owners to existing beneficial uses, when made a part of a water code providing more economic distribution of the surplus water thus conserved, is reasonably calculated to affect this public interest."

---

[11] A brief article under the heading "Comment" and signed "C. M. N.": Michigan Law Review, vol. 34, pp. 274-280, 1935.

Finally, it may be pointed out that the United States Supreme Court has specifically upheld the right of a State to change from the common law rule of riparian ownership and adopt the rule of appropriation. In the United States v. Rio Grande Irrigation Co. (174 U. S. 690, 1899) the court said, (page 702):

> "*** as to every stream within its domain a State may change this common law rule and permit the appropriation of the flowing water for such purposes as it deems wise***"

In summary, bearing in mind these expressions of the Supreme Court of the United States, although they do not relate specifically to ground waters, the present writers have not been able to escape the conviction that, provided there is sufficient public sentiment to obtain the necessary legislation, in almost any State of the Union, where there is not now any constitutional prohibition, it may be possible to provide for the adoption of the rule of appropriation of ground waters not necessarily by constitutional amendment, but perhaps by the enactment of a carefully written statute.

Only by making an attempt can it be determined whether it will ever be possible to break away from the doctrines, which, with plenty of time to test them have proved to be a failure in conserving our groundwater supplies. This task requires the cooperation of the lawyers, but the geologists and engineers should see to it that the lawyers clearly understand the scientific principles of groundwater hydrology that are involved in order that they may properly provide for the efficient utilization and conservation of the ground-water supplies of the country.

The writers wish to acknowledge the benefit of discussion of some of the problems herein considered with O. E. Meinzer and J. F. Deeds of the Geological Survey, and H. D. Padgett.

Geological Survey

(Continued from Page 16.)

Growth occurs only in the active subdelta. Destruction of abandoned subdeltas in the zone of wave attack is marked by their receding beaches and eventually straightened shore lines. Similar destruction of former active deltas to the west was suggested in a former study (R. J. Russell and H. V. Howe: Cheniers of Southwestern Louisiana, *Geogr. Rev.*, Vol. 25, 1935, pp. 449-461).

A main thesis of the book is that sinking under the load of accumulating sediments is characteristic of the deltas of the world, as is evidenced by their almost universally exhibited marginal lagoons, here interpreted as depressions, and by a mass of detailed data for the Missisippi, incluling much new and convincing evidence. The steepened gradient of the former main river channel in the recently abandoned St. Bernard subdelta is an incontrovertible evidence of tilt. The reviewer's studies of Pleistocene and Recent deltas of the Texas and Mexican coasts of the Gulf of Mexico present nothing in conflict with, and much in support of, this conclusion. The gulfward tilt in Pleistocene deltas described by John Doering (Post-Fleming Surface Formations of Coastal Southeast Texas and South Louisiana, *Bull. Amer. Assn. of Petroleum* Geologists, Vol. 19, 1935, pp. 651-688) is supported by Russell and is confirmed by the reviewer's studies. Compaction and local settling as causes of the subsidence phenomena are thought to be of minor and local effect respectively.

Subsidence would preserve the great mass of deltaic sediments below the zone of marine plantation. In this way Russell explains the formation of the Gulf-coast geosyncline. He does not attempt to diagram the structure of a delta in three dimensions but rejects the textbook conception of top-set, fore-set, and bottom-set beds. The reviewer would suggest that fore-set beds might occur in deltas of other classes than that of great sea-level deltas of coastal plains, whose pattern of sedimentation seems to leave no place for rapid deposition on steep slopes. Here downward warping would probably relegate inclined deposition to the role of minor cross-bedding, if such a feature exists in deposits of fine silt, such as those of the Mississippi Delta.

The theory that offshore bars can be formed only on a "shoreline of emergence," established by the writings of Gulliver, Douglas Johnson, and their followers, is opposed to the idea of coastal subsidence and tilt in the Gulf. The Padre Island offshore bar of the Texas coast and similar examples have been cited by Johnson and others as marking a shore line of emergence where a recent "slight" submergence has occurred. The St. Bernard offshore bar (Chandeleur Islands) is definite proof opposed to this idea of exclusiveness in the linkage of bars and "emergence." No proof of emergence known to the reviewer has been adduced for the Texas coast, except that the present sea level has failed by 12 feet to reach the elevation of the high-level, late-Sangamon sea of the Ingleside terrace. The striking drowned gorges of the Gulf coast are recognized by all.

Shore-Line Types

It seems to the reviewer that generalizations regarding shore-line types and histories for the Atlantic and Gulf coasts must now be reorganized to fit the concept and history of eustatic (largely glacial-control) oscillations. Locale inevitably influences the development of geologic theories. Johnson, for example, takes as his "normal" shore line of submergence one whose bordering lands have hilly relief (D. W. Johnson: Shore Processes and Shoreline Development, New York and London, 1919). Russell is dealing with the coastal-plain type of uneroded, alluvial-plain shore line. For the latter "exception" Johnson notes that the developmental histories of emergent and submergent shore lines will "resemble" each other. Russell suggests that in the description of shore lines the terms "advancing" and "retreating" are to be preferred to "emergent" and "submergent". He notes a "quite recent channel-intrenchment (p. 155), followed by "alluvial drowning," evidently thought to have been as much as 200 feet at one point. This is believed to have interrupted delta development within the area at a time when the river flowed west of the present active delta, in possible connection, it is suggested, with submarine canyon features heading toward Atchafalaya Bay, recently described by Francis P. Shepard ("Salt" Domes Related to Mississippi Submarine Trough, *Bull. Geol. Soc. of America*, Vol. 48, 1937, pp. 1349-1361).

"The thesis that drainage patterns determine future courses of mountains was first advanced to the writer by Dr. H. V. Howe." This thesis seems so well substantiated by the facts and conclusions brought out in this work that the author (and the reviewer) now accepts it with little reservation. "It seems to point the way" toward a better understanding of "the initiation of one of geology's most impressive patterns, the development of great depositional troughs that later become mountain ranges, than any other hypothesis" with which he is acquainted.

In this stimulating work many physiographic details and local features are interestingly treated and new views developed. These include new ideas of meandering, clarification of the local "mudlump" and "blue clay" problems, and important contributions to the hydrography of submerged marshes and tidal channels (Figs. 5-10). Studies of soils, vegetation, Indian pottery cultures and chronology, Indian molluscan-food types in relation to changing depths of water, and other accessory phenomena are skillfully used in the study of delta history and subsidence. The turbulence theory of transportation of sediments is discussed and used.

A somewhat dogmatic flavor is given to the physiographic study by what the reviewer regards as omissions. Such omissions—apparently made necessary by limitations of time and space in publication—include more detailed descriptions of the terrain and abundant reproductions from topographic maps and airplane photographs, diagrams showing the results of soil-auger investigations, and cross-sectional diagrams of natural levees, beaches, and "depression" lakes. The inclusion of such aids to visualization of the problems of the book would have emphasized the large amount of detailed information on which the study was based, including maps and data from field investigations, and would have helped to strengthen the author's conclusions. As it is, the book should be studied with a full equipment of topographic and hydrographic maps of coastal Louisiana at hand.

W. ARMSTRONG PRICE

The Spawning Habits of Fish

(Continued from Page 51)

cient oxygen, proper temperature and other environmental conditions favorable for organisms living in water.

The spawning habits of fish and the species of fish present in a lake, or stream, dictate where spawning signs must be placed to protect the fish and their eggs during the spawning period. If boats are pushed into shallow areas among rushes where eggs have been deposited, much injury to the spawning area will result.

Likewise, if any sort of wading, either by man or cattle is allowed, the nest building fish, such as the crappie, bluegill, and bass, will, of course, be chased away from their circular nests among the rushes, and very likely the nests will be obliterated.

The provision and protection of spawning areas holds equal importance with proper food supply and other environmental conditions necessary to promote good fishing.

Use of Gasoline and The Rate of Tax

The rate of gasoline tax in the different States does not appear to seriously influence consumption. Reports from the States to the Bureau of Public Roads show that for the last 2 years the greatest increases in consumption—with two exceptions—have been in States with tax rates above the average.

In 1937, 12 States increased their gasoline consumption by more than 10 percent. In 10 of them the tax ranged from 4 to 7 cents. During the year 4 States increased the rate of tax by 1 cent, so that the average rate for the United States rose from 3.85 cents in 1936 to 3.91 cents in 1937. Rates of tax ranged from 2 cents in the District of Columbia and Missouri to 7 cents in Florida, Louisiana, and Tennessee.

The 6 States—New York, California, Pennsylvania, Illinois, Ohio, and Texas— in which consumption exceeded a billion gallons each, are all in the 3- or 4-cent tax zone. Nebraska and Tennessee were the only States that did not report 1937 consumption exceeding 1936. New York—with 1,702,621,000 gallons, netting the State nearly $62,000,000—leads in both volume and receipts. For the United States the totals for 1937 are 19,218,121,000 gallons taxed for highway use, for which the States collected $756,930,000. Other receipts under gasoline-tax laws brought the total to $761,998,000.

Poison Ivy

Poison Ivy, feared by many, is now appearing in the creeping and climbing stage in the woods and fields. To assist those not familiar with the plant, it is described as being a member of the Sumac family; grows about 18 inches high before beginning to creep or climb on other plants, shrubs or trees. Often it is found creeping along the ground.

The first identification of the poison plant is the three leaves on one stem. There are other plants with three leaves on one stem but poison ivy leaves are nearly smooth edged. They are not definitely notched or toothed as others are. The color of the leaf above is light green and is not shining. The shrub or plant produces a whitish green flower and in later season and fall white berries will appear. Contact with the plant produces a burning eruption of the skin.

A physician should be consulted as soon as possible. A comforting treatment until a physician can be consulted is the application of extract of witch hazel by wrapping the inflamed parts with well saturated cloths.

Oil and Gas Wells Completed in North Louisiana During 4th Quarter of 1937

Field	Name of Company	Name of Well	Date Completed	Initial Daily Production	Size Choke (Inch)	Gravity	Total Depth (Feet)
BEAR CREEK (Bienville Ph.)	Hunt Oil Co. & Seaboard Oil Co. (Gas)	Federal Land Bank #1	12/12/37	1 MCF*	......	......	7,879
BELLEVUE (Bossier Ph.)	C. H. French	Larkin #1	10/15/37	15 Bbls.	......	......	386
BLANCHARD (Caddo Ph.)	A. O. Olson (Gas)	R. T. Sharp #1	12/10/37	10 MCF	......	......	5,624
BULL BAYOU (Red River De Soto Phs.)	T. G. Shaw	Wilkerson #4	10/20/37	15 Bbls.	......	......	386
	W. E. Williams (Gas)	Prudhome #1	11/1/37	9 MCF	......	......	......
	Petroleum Heat & Power Co.	Cavanaugh #1	12/20/37	84 Bbls.	1/4	......	2,841
	Gulf Refg. Co.	E. T. Robinson #42	10/7/37	11 Bbls.	Pump	41.2	2,552
CADDO DISTRICT (Caddo Ph.)	Grogan, Crittenden, Chew & Chew	Spell #2	10/15/37	400 Bbls.	......	27.5	1,522
	W. H. Harrison, Jr. (Gas)	Shoreline Crystal #1	10/28/37	1 MCF	......	......	1,036
	H. & H. Drilling Co.	S. C. Helpman #1	11/9/37	40 Bbls.	......	......	1,004
	Gulf Refg. Co.	Curtis #6	12/27/37	5 Bbls.	Pump	36.4	2,235
CONVERSE (Sabine Ph.)	Major Oil Co.	Graham & Allen #1	11/20/37	42 Bbls.	Pump	43.6	1,710
COTTON VALLEY (Webster Ph.)	Ohio Oil Co.	Bodcaw Lbr. Co. #47	10/22/37	185 Bbls. & 3 MCF	5/16	73.0	8,459
	Ohio Oil Co.	T. Crichton #2	10/13/37	247 Bbls. & 3 MCF	5/16	72.0	8,458
	Ohio Oil Co.	R. L. Holloway #B-7	10/18/37	306 Bbls. & 4 MCF	5/16	73.0	8,188
	Ohio Oil Co.	D. W. Merritt #1	10/28/37	378 Bbls. & 4 MCF	5/16	73.0	8,344
	Magnolia Petroleum Co.	Aarnes-Cox #4	11/10/37	709 Bbls. & 8 MCF	1/2	73.0	8,418
	Ohio Oil Co.	Coyle & Cox #1	11/5/37	342 Bbls. & 2 MCF	5/16	73.0	8,119
	A. G. Oliphant	Sam Banks #1	11/5/37	288 Bbls. & 3 MCF	20/64	62.4	8,187
	Standard Oil Co. of La.	M. E. Davis #7	11/26/37	192 Bbls.	1/4	......	8,258
	Standard Oil Co. of La.	M. E. Gray #B-2	11/23/37	216 Bbls.	1/4	......	8,117
	V. L. Foster	McCook & Hibbler #2	12/12/37	960 Bbls. & 1 MCF	......	66.0	8,339
	Union Producing Co.	T. C. Tillman #6	12/26/37	445 Bbls. & 6 MCF	3/8	......	8,290
LISBON (Claiborne Ph.)	Atlantic Refg. Co.	F. B. King #5	10/18/37	840 Bbls.	3/4	......	5,218
	Atlantic Refg. Co.	Patton #C-1	10/16/37	1,680 Bbls	3/4	......	5,187
	R. L. Bauman	C. S. L. Patton #1	10/2/37	1,555 Bbls.	1	34.6	5,307
	R. L. Bauman	C. S. L. Patton #2	10/27/37	1,680 Bbls.	......	35.6	5,367
	Harry Hanbury	R. Vaughn #D-2	10/19/37	1,166 Bbls.	32/64	34.6	5,187
	Hollyfield & McFarlane	H. W. Patton #2	10/9/37	1,879 Bbls.	1	34.6	5,220
	Magnolia Petroleum Co.	F. Corbin #2	10/14/37	913 Bbls.	1/2	32.0	5,318
	A. O. Olson	H. W. Patton #1	10/30/37	506 Bbls.	8/64	34.5	5,273
	A. O. Olson	T. F. Patton #A-4	10/26/37	583 Bbls.	12/64	34.6	5,197
	Scout Oil Co.	J. T. Bean #1	10/25/37	264 Bbls.	12/64	34.6	5,159
	Sloan & Zook	H. W. Patton #3	10/11/37	129 Bbls.	8/64	34.6	5,280
	J. C. Tippett	C. S. L. Patton #1	10/11/37	990 Bbls.	1/2	34.5	5,372
	Atlantic Refg. Co.	Patton #C-2	11/17/37	388 Bbls.	12/64	34.2	5,203
	H. Hanbury	R. Vaughn #E-1	11/23/37	49 Bbls.	16/64	34.4	5,222
	Harmon-Greenwald Crescent Drlg. Co.	J. B. Fowler #1	11/23/37	330 Bbls.	32/64	34.6	5,285
	A. O. Olson	English #1	11/25/37	477 Bbls.	32/64	34.5	5,204
	A. O. Olson	T. F. Patton #A-5	11/24/37	1,555 Bbls.	30/64	34.6	5,206
	Red Iron Drlg. & E. W. Gill	S. M. English #1	11/7/37	528 Bbls.	24/64	34.4	5,150
	Sloan & Zook	H. W. Patton #4	11/6/37	259 Bbls.	3/4	35.1	5,291
	Tippett Oil Corp.	C. S. L. Patton #2	11/15/37	1,452 Bbls.	1/2	34.6	5,335
	Vaughn-Marr	J. T. Eppinger #2	11/30/37	792 Bbls.	32/64	34.6	5,133
	Atlantic Refg. Co.	J. T. Bean, Jr. #B-1	12/28/37	194 Bbls.	10/64	34.5	5,210
	T. L. James & Co.	T. A. Tanner #1	12/31/37	388 Bbls.	1/4	34.6	5,220
	T. L. James & Co.	T. A. Tanner #2	12/30/37	356 Bbls.	1/4	34.6	5,252
	Scout Oil Corp.	English #2	12/6/37	594 Bbls.	24/64	34.5	5,162
	Sloan & Zook Co.	M. S. Patton #1	12/1/37	1,296 Bbls.	3/4	34.6	5,391
	Sloan & Zook Co.	H. W. Patton #5	12/24/37	744 Bbls.	3/4	34.5	5,391
	Tippett Oil Corp.	Aycock #B-1	12/27/37	1,320 Bbls.	1/2	34.6	5,359
	C. H. Vaughn & Marr	F. B. King #2	12/31/37	1,166 Bbls.	1/2	34.5	5,135
(Lincoln Ph.)	Lyons & Neely	H. E. Patton #B-2	10/10/37	594 Bbls.	16/64	34.6	5,332
	Lyons & Neely	H. W. Patton #2	10/1/37	396 Bbls.	22/64	34.6	5,335
	Red Iron Drlg. Co.	T. F. Patton #1	10/9/37	960 Bbls.	1/2	......	5,254
	Gulf Refg. Co.	M. Patton #1	11/24/37	792 Bbls.	32/64	34.6	5,283
	Magnolia Petroleum Co.	F. Corbin #B-1	11/22/37	628 Bbls.	20/64	34.5	5,257
	Red Iron Drilling Co.	T. F. Patton #2	11/25/37	594 Bbls.	3/4	34.5	5,256
	Gulf Refg. Co.	M. Patton #2	12/28/37	198 Bbls.	14/64	34.6	5,253
MONROE (Morehouse, Ouachita and Union Parishes)	Southern Carbon Co.	Tensas Delta #20	10/28/37	5 MCF	......	......	2,180
	Southern Carbon Co.	Tensas Delta #19	10/7/37	5 MCF	......	......	2,175
	W. L. Ethridge	Phillips #1	10/25/37	1 MCF	......	......	2,230
	Hope Prod. Co.	Cole #11	10/29/37	2 MCF	......	......	2,175
	Hope Prod. Co.	Cole Heirs #10	10/9/37	1 MCF	......	......	2,182
	J. & H. Oil Co.	Frost Lbr. #B-5	10/4/37	1 MCF	......	......	2,235
	Interstate Nat'l Gas Co.	Fee #75	10/25/37	3 MCF	......	......	2,215
	J. & H. Oil Co.	Union Power Co. #C-3	10/9/37	2 MCF	......	......	2,259
	J. & H. Oil Co.	Union Power Co. #C-4	10/24/37	2 MCF	......	......	2,270
	J. & H. Oil Co.	Union Power Co. #C-5	10/23/37	3 MCF	......	......	2,240
	Union Prod. Co.	Fannie Williams #2	10/20/37	8 MCF	......	......	2,150
	Hope Prod. Co.	Cole Heirs #12	11/27/38	2 MCF	......	......	2,166
	Interstate Nat'l Gas Co.	Fee #77	11/5/37	27 MCF	......	......	2,150
	J. & H. Oil Co.	Union Power #C-6	11/11/37	2 MCF	......	......	2,265
	J. & H. Oil Co.	Union Power #C-7	11/26/37	2 MCF	......	......	2,140
	Southern Carbon Co.	Fee #70	11/2/37	9 MCF	......	......	2,183
	Southern Carbon Co.	Grayling #22	11/20/37	6 MCF	......	......	2,160
	Southern Carbon Co.	Grayling #23	11/28/37	4 MCF	......	......	2,264
	Union Prod. Co.	Fee #68-1	11/24/37	22 MCF	......	......	2,165
	Union Prod. Co.	Fee #105-1	11/11/37	17 MCF	......	......	2,165
	Union Prod. Co.	M. A. Jordan #1	11/2/37	2 MCF	......	......	2,198
	Union Prod. Co.	Sims #1	11/29/37	2 MCF	......	......	2,170
	Southern Carbon Co.	Grayling #24	12/29/37	3 MCF	......	......	2,220
	Union Prod. Co.	Barr #A-1	12/3/37	1 MCF	......	......	2,283
	Union Prod. Co.	Fee #105-2	12/12/37	15 MCF	......	......	2,180

---

* MCF—Million cubic feet of gas.

Field	Name of Company	Name of Well	Date Completed	Initial Daily Production	Size Choke (Inch)	Grav-ity	Total Depth (Feet)
PINE ISLAND (Caddo Ph.)	Stanolind Oil & Gas Co.	Dillon Heirs #128	10/7/37	6 Bbls.	Pump	38.6	1,660
	Stanolind Oil & Gas Co.	Dillon Heirs #129	10/22/37	9 Bbls.	Pump	36.0	1,665
	M. J. Grogan	T. S. Spell #3	11/9/37	100 Bbls.	....	27.5	1,580
	Magnolia Petroleum Co.	S. J. Robertshaw #28	11/23/37	117 Bbls.	....	38.7	1,650
	Simplex Oil Co	Glassell #12	11/15/37	200 Bbls.	....	26.0	2,195
	Stanolind Oil & Gas Co.	Dillon Heirs #130	11/3/37	91 Bbls.	Pump	35.7	1,700
	Magnolia Petroleum Co.	Dillon #22	12/28/37	20 Bbls.	....	38.7	1,730
RODESSA (Caddo Ph.)	Gulf Refg. Co.	N. G. Campbell #2	10/18/37	66 Bbls.	12/64	42.8	6,060
	Magnolia Petroleum Co.	G. W. Hardy #1	10/5/37	364 Bbls.	1/4	40.7	6,055
	R. W. Norton	W. N. Starcke #7	10/14/37	240 Bbls.	3/8	......	5,985
	R. W. Norton	W. N. Starcke #10	10/8/37	194 Bbls.	1/8	42.8	5,980
	Standard Oil Co. of La.	Emma J. Parker #C-1	10/2/37	154 Bbls.	1/4	......	6,012
	Surf Oil Co.	L. O. Allison # 1	10/28/37	40 Bbls.	tbg.	......	6,059
	Ralph G. Trippett	Davis-McKinney #1	10/24/37	132 Bbls.	1/4	44.0	5,965
	F. W. Burford	R. A. Terry #1	11/8/37	1,566 Bbls.	1	43.0	6,042
	Standard Oil Co. of La.	N. Gibson #1	11/17/37	393 Bbls.	22/64	43.6	5,947
	Standard Oil Co. of La.	J. E. McCoy #3	11/2/37	1,200 Bbls.	1/2	......	5,959
	R. G. Tripett	Davis-McKinney #2	11/18/37	325 Bbls.	1/4	44.0	5,960
	Union Prod. Co.	Starcke #6	11/29/37	138 Bbls.	18/64	44.6	6,020
	Vaughn Prod. Co.	Yates #1	11/6/37	1,100 Bbls.	3/4	41.0	5,997
	Vaughn Prod. Co.	G. Yates #2	11/30/37	473 Bbls.	3/8	......	6,008
(Gas)	F. W. Burford	M. G. Pitts #1	11/4/37	13 MCF	....	......	6,070
(Gas)	Magnolia Petroleum Co.	Mary S Atkins #4	11/21/37	9 MCF	....	......	5,900
	Magnolia Petroleum Co.	G. W. Hardy #2	11/29/37	110 Bbls. & 5 MCF	....	65.5	6,012
	F. W. Burford	Lorraine G. Cleveland #2	12/7/37	375 Bbls.	16/64	42.6	5,976
	F. W. Burford	R. A. Terry #2	12/24/37	600 Bbls.	1	......	6,048
	Gulf Refg. Co.	H. A. Allison #1	12/17/37	138 Bbls.	21/64	43.0	6,024
	Shell Petroleum Corp.	U. S. Mineral Land #1	12/13/37	116 Bbls.	1/4	......	5,953
	Standard Oil Co. of La.	J. E. McCoy #4	12/14/37	484 Bbls.	22/64	......	....
	Tripett	Madie Sharp #1	12/10/37	74 Bbls.	12/64	44.0	5,997
	Union Prod. Co.	Walter Starcke #7	12/31/37	154 Bbls.	1/4	45.2	5,967
	G. H. Vaughn	Sartor #1	12/21/37	1,200 Bbls.	1	42.0	6,026
	F. W. Burford	U. S. Gov. #1	12/1/37	16 Bbls. & 1 MCF	1	63.0	6,060
	F. W. Burford	Terry #4	12/2/37	48 Bbls. & 3 MCF	32/64	58.4	6,030
SLIGO (Bossier Ph.) (Gas)	Ark. La. Gas Co.	R. O. Roy #4	10/20/37	40 MCF	....	......	5,028
	Triangle Drlg. Co.	Scbuler Estate #A-1	10/5/37	48 Bbls.	....	41.0	3,119
URANIA (La Salle Ph.)	J. E. Grandstaff	K. Russell #B-1	10/29/37	5 Bbls.	Pump	......	1,540
	Petroleum Heat & Power Co.	Wright #1	10/28/37	40 Bbls.	Pump	......	1,545
	T. & J. Oil Co.	Town of Tullos #1	10/19/37	30 Bbls.	Pump	21.0	1,538
	T. & J. Oil Co.	Town of Tullos #2	10/28/37	40 Bbls.	Pump	......	....
	Trio Oil Co.	Urania Lbr. Co. #A-1	11/15/37	30 Bbls.	Pump	......	....
ZWOLLE (Sabine Ph.)	Hunter Co.	Bowman-Hicks Lbr. Co. #1	10/31/37	216 Bbls.	1/4	41.0	2,462

Oil and Gas Wells Completed in South Louisiana During 4th Quarter of 1937

ABBEVILLE (Vermilion Ph.)	Continental Oil Co.	J. H. Brookshire #1	11/3/37	218 Bbls.	5/32	42.8	7,890
	Continental Oil Co.	Orphe C. Hebert #1	12/7/37	203 Bbls.	1/8	41.6	7,897
ANSE LA BUTTE (St. Martin Ph.)	Austin B. Taylor	Central Oil Co. #1	11/25/37	288 Bbls.	1/4	24.8	1,610
	Butte Oil Co.	H. Billeaud et al #1	12/8/37	30 Bbls.	....	20.8	815
BATEMAN LAKE (St. Mary Ph.)	The Texas Co.	State Bateman Lake #1	12/24/37	674 Bbls.	1/4	35.2	10,910
BLACK BAYOU (Cameron Ph.)	Shell Petroleum Co.	J. B. Watkins #36	11/16/37	640 Bbls.	16/64	24.9	5,033
CAILLOU ISLAND (Terrebonne Ph.)	The Texas Co.	Caillou Island #52	10/24/37	498 Bbls.	3/8	27.1	3,762
CAMERON MEADOWS (Cameron Ph.)	Burton-Sutton Oil Co.	School Land #20	12/30/37	172 Bbls.	1/4	30.0	4,086
CHARENTON (St. Mary Ph.)	Pan American Prod. Co.	Laws Realty Co. #4	10/17/37	1 MCF	1/8	......	7,178
	Pan American Prod. Co.	A. Veeder Co. Inc. #2	12/31/37	336 Bbls	1/4	23.6	1,902
DARROW (Ascension Ph.)	Humble Oil & Refg. Co.	S. Gumbel #12	12/2/37	722 Bbls.	1/4	39.4	6,985
DOG LAKE (Terrebonne Ph.)	The Texas Co.	State Dog Lake #20	10/17/37	1,537 Bbls.	3/8	39.0	6,875
GARDEN ISLAND BAY (Plaquemines Ph.)	The Texas Co.	Garden Is. Bay #24	11/11/37	310 Bbls.	5/16	37.5	5,426
GIBSON (Terrebonne Ph.)	Shell Petroleum Corp.	Pelican #2	10/13/37	1,002 Bbls.	1/4	38.8	9,495
	Shell Petroleum Corp.	Pelican #3	10/28/37	972 Bbls.	1/4	37.7	9,506
	Shell Petroleum Corp.	Realty Operators #B-3	11/23/37	932 Bbls.	1/4	37.7	9,500
HARANG (Lafourche Ph.)	Pan American Prod. Co.	Harang #9-A	10/7/37	643 Bbls.	1/4	31.9	5,403
	Pan American Prod. Co.	Harang #11	10/1/37	675 Bbls.	1/4	32.9	5,407
	Pan American Prod. Co.	Harang #10	11/7/37	643 Bbls.	1/4	32.8	6,143
	Pan American Prod. Co.	Harang #14	12/22/37	611 Bbls.	1/4	38.7	6,934
IOWA (Calcasieu-Jeff.-Davis)	Magnolia Petroleum Co.	B. T. Waite #12	11/6/37	192 Bbls.	1/4	25.6	4,426
JEANERETTE (St. Mary Ph.)	Herton Oil Co.	Roane & Banta #1	10/9/37	272 Bbls.	1/4	34.8	10,420

Field	Name of Company	Name of Well	Date Completed	Initial Daily Production	Size Choke Inch	Grav-ity	Total Depth (Feet)
JENNINGS (Acadia Ph.)	Glassell & Glassell	Robt. McFarland #3	10/10/37	820 Bbls.	1/4	40.8	7,098
	Ladak Oil Co., Inc.	Jules Clement #2	10/25/37	250 Bbls.	....	25.0	2,055
	Superior Oil Co.	Jennings-Heywood #4	10/30/37	417 Bbls.	14/64	39.4	6,500
	Frank W. Bennett	U. B. & C. #1	11/21/37	792 Bbls.	1/4	39.8	7,700
	Burton-Noble-Baker	Robira #4	11/25/37	804 Bbls.	1/4	39.0	7,021
	Glassell & Glassell	McFarlan #2	11/6/37	771 Bbls.	1/4	40.2	6,975
	La. Crusaders Oil Co.	Edwin H. Grace #1	11/22/37	235 Bbls.	1/4	31.0	3,811
	Superior Oil Co.	Wm. Leckelt #8	11/20/37	450 Bbls.	16/64	38.3	6,919
	Superior Oil Co.	A. P. Moresi #3	11/16/37	514 Bbls.	14/64	38.5	6,844
	Austin B. Taylor	E. H. Grace #1	11/23/37	264 Bbls.	1/4	29.8	3,715
	Glassell & Glassell	Gus Trushell #4	12/20/37	771 Bbls.	1/4	40.0	6,976
	Ladak Oil Co.	Jules Clement #1	12/4/37	100 Bbls.	....	25.0	1,997
	O'Meara Brothers	A. P. Moresi #1	12/27/37	779 Bbls.	1/4	40.0	7,049
	Superior Oil Co.	Wm. Leckelt #7	12/19/37	514 Bbls.	13/64	39.0	7,162
LAFITTE (Jefferson Ph.)	The Texas Co.	Madison Realty Co. #2 (R. C. Milling #2)	10/11/37	1,750 Bbls.	3/8	37.4	10,111
	The Texas Co.	LLE Lafitte #7	11/25/37	1,267 Bbls.	3/8	37.3	10,275
	The Texas Co.	Bayou Norman #1	11/1/37	1,817 Bbls.	3/8	36.8	9,637
	The Texas Co.	Rigolets Cooperative Fur Co. #8	12/29/37	1,575 Bbls.	3/8	34.8	10,285
LAKE BARRE (Terrebonne Ph.)	The Texas Co.	Lake Barre #41	11/11/37	363 Bbls.	1/4	28.0	3,679
LAKE PELTO (Terrebonne Ph.)	The Texas Co.	Lake Pelto #13	12/13/37	909 Bbls.	3/8	37.0	6,555
NEW IBERIA (Iberia Ph.)	William Helis	Bullock #6	10/24/37	631 Bbls.	5/16	27.4	3,940
	The Texas Co.	J. P. Duhe #4	10/26/37	739 Bbls.	5/16	31.0	4,350
	The Texas Co.	Celeste Gralino #3	10/29/37	767 Bbls.	5/16	30.2	5,100
	The Texas Co.	Hanszen #B-7	10/17/37	385 Bbls.	....	24.8	4,792
	The Texas Co.	Hanszen #B-9	12/29/37	321 Bbls.	5/16	35.1	5,216
NORTH CROWLEY (Acadia Ph.)	Humble Oil & Refg. Co.	Anton Ohlenforst #1	10/26/37	765 Bbls.	1/4	37.0	8,107
QUARANTINE BAY (Plaquemines Ph.)	Gulf Refg. Co.	State "QQ" #3	11/28/37	840 Bbls.	1/4	36.3	8,204
ROANOKE (Jefferson Davis Ph.)	Humble Oil & Refg. Co.	C. N. Taylor #4	10/14/37	594 Bbls.	1/4	38.4	8,839
	Humble Oil & Refg. Co.	DeVilbiss #B-9	11/16/37	691 Bbls.	1/4	38.9	8,859
SOUTH ROANOKE (Jefferson Davis Ph.)	Union Sulphur Co.	T. R. S. Farm Co. #1	10/10/37	40 Bbls.	....	48.9	8,564
SOUTH JENNINGS (Jefferson Davis Ph.)	Loffland Brothers & Stanolind Oil & Gas Co.	Isaac Fontenot #1	12/24/37	32 Bbls.	14/64	50.0	8,663
SULPHURMINE (Calcasieu Ph.)	Union Sulphur Co.	Fee #849	10/1/37	84 Bbls.	....	27.8	5,104
	Union Sulphur Co.	Fee #850	10/5/37	300 Bbls.	1/4	32.8	5,149
	Union Sulphur Co.	Fee #847	10/11/37	230 Bbls.	3/16	31.0	5,130
	Union Sulphur Co.	Fee #851	11/30/37	240 Bbls.	3/16	30.3	5,137
	Union Sulphur Co.	Fee #853	12/8/37	208 Bbls.	3/16	29.9	4,730
VENICE (Plaquemines Ph.)	Tide Water Associated Oil Company	Manhattan Land & Fruit #4	12/1/37	480 Bbls.	3/16	40.6	7,149
WEST HACKBERRY (Cameron Ph.)	Stanolind Oil & Gas Co.	Carter & Sweeney #11	10/16/37	132 Bbls.	1/4	31.4	3,945
	Stanolind Oil & Gas Co.	State of La. #53	10/10/37	286 Bbls.	....	30.0	5,880
	Stanolind Oil & Gas Co.	Mary Duhon #7	11/21/37	120 Bbls.	1/4	24.0	3,314
	Stanolind Oil & Gas Co.	Mary Duhon #6	12/7/37	149 Bbls.	1/4	21.2	3,130
	Stanolind Oil & Gas Co.	Gulf Land Roy a/c #B-26	12/7/37	389 Bbls.	1/4	21.8	3,124
WHITE CASTLE (Iberville Ph.)	Shell Petroleum Corp.	White Castle Lbr. Co. #5	10/31/37	642 Bbls.	1/4	25.5	6,444

Oil and Gas Wells Completed in North Louisiana During 1st Quarter of 1938

BLANCHARD (Caddo Ph.)	O. A. Olson	Percy Sharp #1	3/27/38	21 Bbls. & 10 MCF	14/4	51.0	6,002
BULL BAYOU (De Soto Ph.)	Jal Drilling Co.	Scales #A-10	1/18/38	93 Bbls.	Pump	.....	2,450
	A. P. Barrett	Jal #1	2/13/38	24 Bbls.	Pump	44.0	2,783
	Petroleum Heat & Power Co.	Jal (Lanier) #1	2/13/38	180 Bbls.	1/2	.....	2,754
(Gas)	Maja Oil Co.	Giauque #1	3/30/38	3½ MCF*	....	.....	2,746
	Petroleum Heat & Power Co.	S. G. Samplen #1	3/30/38	40 Bbls.	....	.....	2,680
(Gas)	Petroleum Heat & Power Co.	Matthews #2	3/22/38	6 MCF	....	.....	2,505
CADDO DISTRICT (Caddo Ph.)	W. H. Harrison, Jr.	Shoreline-Crystal Fee #3	3/1/38	18 Bbls.	....	33.5	2,269
CONVERSE (Sabine Ph.)	Royal Oil & Gas Co.	J. E. Graham #1	1/2/38	60 Bbls.	Pump	44.4	1,799
	Major Oil Co.	J. E. Graham #1	2/7/38	24 Bbls.	Pump	43.0	1,668
COTTON VALLEY (Webster Ph.)	Magnolia Petroleum Co.	Crichton Heirs #1	1/8/38	660 Bbls.	7/16	.....	8,332
	Magnolia Petroleum Co.	J. T. Marshall #7	1/21/38	768 Bbls.	1/2	61.4	8,405
	Ohio Oil Co.	Warren Cox #2	1/29/38	486 Bbls.	3/8	62.0	8,108
	A. G. Oliphant	A. J. Hodges #1	1/18/38	1,360 Bbls. & 1 MCF	1/2	51.0	5,677
	Woodley Petroleum Co.	Gray #B-5	1/14/38	500 Bbls. & 2 MCF	5/16	63.0	8,142
	W. G. Ray Drlg. Co.	D. W. & E. L. Stewart #1	1/6/38	500 Bbls.	....	50.0	5,815
	Hunt Oil Co.	Eleanor M. Hope #1	2/11/38	500 Bbls.	1/2	51.0	5,649
	Magnolia Petroleum Co.	J. M. Mixon #2	2/21/38	700 Bbls. & 8 MCF	7/16	62.0	8,325
	No. American Consolidated	R. M. Coyle #1	2/22/38	600 Bbls. & 8 MCF	7/16	62.0	8,340
	Ohio Oil Co.	Bodcau Lbr. Co. Acct. #4-2	2/17/38	725 Bbls. & 9 MCF	3/8	62.0	8,201
	A. G. Oliphant	Sam Banks #2	2/10/38	852 Bbls.	1/2	48.0	5,786
	Magnolia Petroleum Co.	Crichton Heirs #2	3/26/38	981 Bbls.	5/16	.....	5,776
	Ohio Oil Co.	Bodcau Lbr. Co. Acct. #2-48	3/3/38	378 Bbls. & 4 MCF	3/8	62.0	8,400
	A. G. Oliphant	Central Trades & Investment Co. #1	3/10/38	1,040 Bbls. & 9 MCF	1/2	50.4	5,889
	Ohio Oil Co.	A. H. Gray Acct. #1-23	3/2/38	292 Bbls. & 4 MCF	3/8	62.0	8,149

* MCF—Million Cubic feet of gas.

Field	Name of Company	Name of Well	Date Completed	Initial Daily Production	Size Choke Inch	Gravity	Total Depth (Feet)
LISBON (Claiborne Ph.)	Atlantic Refg. Co.	J. T. Bean #B-2	1/29/38	194 Bbls.	10/64	34.6	5,205
	Atlantic Refg. Co.	M. Patton #D-1	1/13/38	792 Bbls.	3/4	34.6	5,244
	E. W. Gill	S. M. English #2	1/6/38	1,752 Bbls.	1/2	......	5,169
	Magnolia Petroleum Co.	J. C. Fowler #1	1/21/38	1,166 Bbls.	1/2	34.6	5,206
	C. R. Schuster	Sally Lloyd #1	1/30/38	174 Bbls.	10/64	34.5	5,269
	Sloan & Zook	H. W. Patton #6	1/31/38	324 Bbls.	Open	34.5	5,302
	Atlantic Refg. Co.	M. Patton #D-2	2/12/38	268 Bbls.	14/64	36.5	5,246
	T. L. James & Co.	D. E. Fowler #2	2/16/38	194 Bbls.	32/64	34.5	5,187
	Jim McMurray	J. T. Bean, Jr. #1	2/13/38	960 Bbls.	3/4	34.4	5,164
	A. O. Olson	S. C. English #2	2/9/38	344 Bbls.	14/64	34.6	5,164
	A. O. Olson	T. F. Patton #A-7	2/17/38	325 Bbls.	16/64	34.5	5,080
	Sloan & Zook Co.	M. S. Patton #2	2/22/38	324 Bbls.	3/4	34.5	5,310
	Tippett Oil Corp.	B. C. Aycock #C-1	2/26/38	1,518 Bbls.	32/64	34.6	5,365
	Vaughn & Marr	J. T. Eppinger #3	2/4/38	673 Bbls.	1/2	34.4	5,122
	Gulf Refg. Co.	Minnie McDonald #1	3/9/38	227 Bbls.	14/64	34.5	5,213
	E. O. Heath	H. W. Patton #C-1	3/25/38	972 Bbls.	24/64	34.6	5,367
	Hollyfield & McFarlane	H. W. Patton #3	3/15/38	2,138 Bbls.	1	34.7	5,246
	Jim McMurry	J. T. Bean, Jr. #2	3/18/38	540 Bbls.	23/64	34.6	5,170
	W. H. North	T. F. Patton #1	3/30/38	396 Bbls.	14/64	34.6	5,345
	Oakes, Carathers & Morelock	Sally Lloyd #2	3/17/38	297 Bbls.	15/64	36.4	5,324
	A. O. Olson	T. F. Patton #A-8	3/20/38	194 Bbls.	15/64	34.6	5,077
	Scout Oil Corp. & Red Iron Drlg. Co.	John Bean, Jr. #2	3/12/38	363 Bbls.	18/64	34.3	5,174
	Texas-Canadian Oil Corp.	T. A. Tanner #1	3/8/38	792 Bbls.	32/64	34.4	5,283
	Vaughn & Marr	F. B. King #3	3/3/38	1,036 Bbls.	32/64	34.5	5,131
(Lincoln Ph.)	F. H. Brown	H. W. Patton #1	1/13/38	280 Bbls.	Pump	34.6	5,357
	J. W. & L. P. Love	H. W. Patton #1	1/1/38	259 Bbls.	23/64	34.6	5,305
	Lyons & Neely	H. W. Patton #B-1	1/31/38	792 Bbls.	32/64	34.5	5,296
	Magnolia Petroleum Co.	F. Corbin #B-2	1/5/38	71 Bbls.	....	......	5,281
	Delta Drlg. Co.	Wise & Tatum #1	2/15/38	528 Bbls.	28/64	34.5	5,341
	Magnolia Petroleum Co.	Pollock Heirs #1	2/13/38	907 Bbls.	32/64	34.6	5,327
	Compton & Hart	H. Patton #1	3/13/38	416 Bbls.	Open	34.5	5,304
	Magnolia Petroleum Co.	Patton Heirs #1	3/2/38	777 Bbls.	32/64	34.5	5,398
	Magnolia Petroleum Co.	Pollock Heirs #2	3/25/38	375 Bbls.	1/2	......	5,341
MONROE (Morehouse, Ouachita and Union Parishes)	Southern Carbon Co.	Grayling #25	1/10/38	3 MCF	....	......	2,196
	Interstate Nat'l Gas Co.	Spencer #8-78	3/3/38	2 MCF	....	......	2,164
	Southern Carbon Co.	U. S. Government #2	3/29/38	3 MCF	....	......	2,207
PINE ISLAND (Caddo Ph.)	M. J. Grogan	T. S. Spell #4	1/29/38	100 Bbls.	....	28.5	1,625
	Magnolia Petroleum Co.	Dillon #23	2/21/38	30 Bbls.	....	38.3	1,690
	J. F. Mitchell	Muslow Oil Co. #1	2/2/38	300 Bbls.	....	......	1,600
	J. Patterson & O. B. O'Mara	Player #1	2/12/38	20 Bbls.	....	27.2	2,258
	D. O. K. Corp.	Player #1	3/18/38	10 MCF	....	......	2,255
RODESSA (Caddo Ph.)	F. W. Burford	Lorraine G. Cleveland #1	1/1/38	1,344 Bbls.	1	......	5,985
	F. W. Burford	R. A. Terry #3	1/27/38	336 Bbls	1/2	......	6,025
	J. S. Rushing (Alice Sidney Oil Co.)	A. M. Alexander #1	1/13/38	264 Bbls.	1/4	......	6,004
	Standard Oil Co. of La.	M. M. Spearman #1	1/31/38	745 Bbls.	1/4	......	......
	Standard Oil Co. of La.	C. M. Terry #1	1/7/38	315 Bbls.	22/64	......	5,992
	R. G. Trippett	Emma Parker #1	1/1/38	15 Bbls.	......	44.0	6,022
	Standard Oil Co. of La.	C. M. Terry #2	1/21/38	792 Bbls.	1/4	......	5,995
	Union Prod. Co.	Harris #5	1/13/38	482 Bbls.	1/4	41.0	5,985
	G. H. Vaughn	Reeves #1	1/5/38	500 Bbls.		41.0	5,985
	Clark Oil Corp.	Madie Sharp #C-1	2/5/38	20 Bbls.	1 3/4	......	6,045
	Union Prod. Co.	Harris #6	2/3/38	276 Bbls.	1/4	45.0	5,940
	F. W. Burford	H. Clay Brown #1	3/6/38	135 Bbls.	Open	42.7	6,100
	J. S. Rushing	Alice M. Alexander #2	3/21/38	450 Bbls.	......	43.2	5,972
	Shell Petroleum Corp.	U. S. Minerals #B-1	3/21/38	183 Bbls.	7/16	44.0	5,972
	Standard Oil Co. of La.	Rodessa O & L Co. #1	3/3/38	455 Bbls.	25/64	......	......
	Standard Oil Co. of La.	M. M. Spearman #2	3/17/38	182 Bbls.	16/64	43.8	5,958
	Union Prod. Co.	Harris #7	3/5/38	211 Bbls.	18/64	43.8	5,950
SLIGO (Bossier Ph.)	Triangle Drlg. Co.	S. A. Herold #A-1	1/5/38	150 Bbls.	....	40.00	3,114
	Triangle Drlg. Co.	S. L. Herold #A-2	2/18/38	100 Bbls.	....	......	3,125
	Triangle Drlg. Co.	Skannal #C-2	3/23/38	1,000 Bbls.	1/2	......	3,121
URANIA (La Salle Ph.)	Graham & Harter	Urania Lbr. Co. #2	3/13/38	20 Bbls.	....	21.0	1,521
	Petroleum Heat & Power Co.	Gaharan #2	3/10/38	15 Bbls.	Pump	......	1,541
ZWOLLE (Sabine Ph.)	W. L. Posey	J. W. Hale #1	1/21/38	150 Bbls.	...	39.0	2,133
	Hunter C., Inc.	Bowman-Hicks #2	2/21/38	145 Bbls.	Pump	40.0	2,563
	Major Oil Co.	Chas. Henry #1	3/5/38	138 Bbls.	3/4	39.0	2,547

Oil and Gas Wells Completed in South Louisiana During 1st Quarter of 1938

ANSE LA BUTTE (St. Martin Ph.)	Ayres Brothers	Begnaud Oil Co. #7	2/1/38	45 Bbls.	Pump	20.1	1,598
BASILE (Acadia Ph.)	Continental Oil Co.	Homeseekers #D-4	1/16/38	256 Bbls.	5/32	33.7	8,313
BIG LAKE (Cameron Ph.)	Union Sulphur Co.	J. O. Hebert #2	3/29/38	200 Bbls.	10/64	39.0	6,786
BLACK BAYOU (Cameron Ph.)	Shell Petroleum Corp.	Watkins #39	1/21/38	649 Bbls.	16/64	24.8	4,620
	Shell Petroleum Corp.	J. B. Watkins #40	3/26/38	138 Bbls.	1/4	....	6,235
CAMERON MEADOWS (Cameron Ph.)	Magnolia Petroleum Co. & Humble Oil & Refg. Co.	Cameron Meadows #21	1/17/38	350 Bbls.	Pump	28.0	3,902
	Burton-Sutton Oil Co.	School Land #21	2/3/38	565 Bbls.	1/4	29.2	4,270
	Burton-Sutton Oil Co.	School Land #22	3/9/38	405 Bbls.	1/4	24.9	4,025

Field	Name of Company	Name of Well	Date Completed	Initial Daily Production	Size Choke Inch	Grav-ity	Total Depth (Feet)
CHARENTON (St. Mary Ph.)	Pan American Prod. Co.	Ecuer #A-1	2/6/38	389 Bbls.	1/4	22.6	2,640
	Pan American Prod. Co.	Ecuer #B-1	2/3/38	256 Bbls.	5/16	22.7	1,895
	Pan American Prod. Co.	E. J. Robichaux #2	2/24/38	299 Bbls.	1/4	22.2	1,896
	Pan American Prod. Co.	Laws Realty Co. #3	3/21/38	215 Bbls.	1/4	23.4	1,891
	Pan American Prod. Co.	E. J. Robichaux #3	3/23/38	235 Bbls.	1/4	24.4	2,652
	Pan American Prod. Co.	A. Veeder Co. Inc. #3	3/9/38	287 Bbls.	1/4	23.9	1,893
DARROW (Ascension Ph.)	Humble Oil & Refg. Co.	Pauline Rose #1	1/7/38	707 Bbls.	1/4	40.1	6,940
	Humble Oil & Refg. Co.	Val E. Landry #2	2/10/38	610 Bbls.	1/4	39.0	6,952
	Humble Oil & Refg. Co.	Gumble #13	3/10/38	706 Bbls.	1/4	30.4	6,954
EAST HACKBERRY (Cameron Ph.)	The Texas Co.	East Hackberry #23	1/3/38	377 Bbls.	1/4	32.0	7,520
	Union Sulphur Co.	Watkins #43	2/1/38	78 Bbls.	3/16	22.4	3,811
GARDEN ISLAND BAY (Plaquemines Ph.)	The Texas Co.	Garden Is. Bay #25	1/14/38	1,637 Bbls.	3/8	36.2	6,126
	The Texas Co.	Garden Is. Bay #26	3/17/38	578 Bbls.	1/4	45.8	7,200
GULF OF MEXICO (Cameron PH.)	Superior Oil Co.	Gulf of Mexico #1	3/11/38	200 Bbls.	7/64	33.9	9,394
GIBSON (Terrebonne Ph.)	Shell Petroleum Co.	Pelican #4	1/25/38	950 Bbls.	1/4	37.7	9,508
	Shell Petroleum Co.	Realty Operators #B-4	3/15/38	996 Bbls.	1/4	37.7	9,502
HARANG (Lafourche Ph.)	Pan American Prod. Co.	Harang #13	1/1/38	627 Bbls.	1/4	32.9	6,134
(Gas)	Pan American Prod. Co.	Harang #16	3/16/38	6 MCF	1/8	50.0	5,190
JENNINGS (Acadia Ph.)	Burton-Noble-Baker	Robira #5	1/19/38	546 Bbls.	1/4	39.9	6,724
	Superior Oil Co.	Jennings-Heywood #5	1/19/38	338 Bbls.	13/64	36.6	6,570
	Port City Oil Co.	Jennings-Heywood #21	1/22/38	400 Bbls.	....	......	1,972
	Superior Oil Co.	Iowa-Jennings #3	2/24/38	450 Bbls.	13/64	39.0	6,847
	Fred I. Getty	Jennings Oil Co.-Heywood #5	3/7/38	300 Bbls.	....	22.5	2,054
	Ladak Oil Co. Inc.	Jules Clement #3	3/5/38	75 Bbls.	....	22.0	1,850
	Superior Oil Co.	Jules Clement #1	3/4/38	583 Bbls.	12/64	42.0	6,977
LAFITTE (Jefferson Ph.)	The Texas Co.	LLE Lafitte #9	2/7/38	1,865 Bbls.	3/8	33.99	10,065
	The Texas Co.	A. Marrero #1	2/14/38	1,767 Bbls.	3/8	35.6	10,275
	The Texas Co.	A. Marrero #2	3/13/38	1,301 Bbls.	3/8	36.6	10,095
LAKE LONG (Lafourche Ph.)	Fohs Oil Co.	Lake Long #3	2/15/38	750 Bbls.	1/4	38.9	9,382
LAKE PELTO (Terrebonne Ph.)	The Texas Co.	Lake Pelto #20	2/19/38	1,125 Bbls.	3/8	......	6,466
LEEVILLE (Lafourche Ph.)	The Texas Co.	LLE Leeville #63	2/7/38	932 Bbls.	3/8	35.1	5,695
NEW IBERIA (Iberia Ph.)	The Texas Co.	Louis P Bryant #3	1/24/38	225 Bbls.	5/16	26.3	5,018
	H. Fotiades	Gulf Refg. Co. #4	3/20/38	108 Bbls.	1/4	27.4	4,426
	Wm. Helis	Bolivar #5	3/25/38	113 Bbls.	1/4	22.4	3,175
	The Texas Co.	H. C. Hanszen #B-10	3/9/38	514 Bbls.	1/4	33.8	5,235
NORTH CROWLEY (Acadia Ph.)	Humble Oil & Refg. Co.	H. J. Habetz #1	1/2/38	843 Bbls.	1/4	36.0	8,148
	Humble Oil & Refg. Co.	Anton Ohlenforst #2	1/29/38	762 Bbls.	1/4	36.8	8,119
	Humble Oil & Refg. Co.	Federal Land Bank of N. O. #2	3/2/38	633 Bbls.	1/4	36.2	7,751
PORT BARRE (St. Landry Ph.)	Pan American Prod. Co.	J. C. Cormier #4	3/22/38	600 Bbls.	1/4	36.8	4,978
RACELAND (Lafourche Ph.)	Amerada Petroleum Corp.	So. Coast #1	1/26/38	753 Bbls.	1/4	35.2	10,212
ROANOKE (Jefferson Davis Ph.)	Humble Oil & Refg. Co.	C. N. Taylor #5	1/21/38	643 Bbls.	1/4	37.2	8,830
	Humble Oil & Refg. Co.	DeVilbiss #B-10	2/17/38	739 Bbls.	1/4	37.4	8,850
	Humble Oil & Refg. Co.	DeVilbiss #B-11	3/13/38	289 Bbls.	1/4	46.2	8,837
STARKS (Calcasieu Ph.)	Lutcher & Moore Lbr. Co.	Lutcher-Moore Lbr. Co. Fee #3	1/23/38	126 Bbls.	....	......	4,367
SULPHURMINE (Calcasieu Ph.)	Union Sulphur Co.	Fee #855	1/17/38	56 Bbls.	Pump	26.7	4,272
	Union Sulphur Co.	Fee #856	3/28/38	192 Bbls.	1/4	34.6	4,856
	Union Sulphur Co.	Fee #858	3/26/38	146 Bbls.	14/64	33.9	5,131
TIMBALIER BAY (Lafourche Ph.)	Gulf Refg. Co.	State "PP" #3	1/25/38	304 Bbls.	12/64	33.3	6,959
UNIVERSITY (East Baton Rouge Ph.)	Louisiana Crusader Oil Co.	Denis A. Duplantier #1	3/22/38	601 Bbls.	1/4	32.6	6,477
VENICE (Plaquemines Ph.)	Tide Water Assoc. Oil Co.	Manhattan Ld. & Fr. Co. #6	3/22/38	593 Bbls.	1/4	41.1	7,156
VILLE PLATTE (Evangeline Ph.)	Continental Oil Co.	La. Central Ld. & Improv. Co. #1	2/9/38	1,118 Bbls.	1/4	41.8	9,060
	Continental Oil Co.	N. H. Hirsch #t	3/25/38	465 Bbls.	3/16	40.3	9,040
	Continental Oil Co.	Ed. Tate #1	3/31/38	204 Bbls.	1/4	62.4	9,040
	Continental Oil Co.	Pierre McDaniel #1	3/29/38	438 Bbls.	3/16	39.4	9,030
WHITE CASTLE (Iberville Ph.)	Shell Petroleum Corp.	Wilbert #11	1/21/38	281 Bbls.	10/64	25.6	6,578
	Shell Petroleum Corp.	White Castle Lbr. & Shg. Co. #6	3/t1/38	640 Bbls.	1/4	25.1	6,449
WOODLAWN (Jefferson Davis Ph.)	Union Sulphur Co.	Calcasieu Nat'l Bank #1	1/4/38	48 Bbls.	3/16	50.0	8,286
WEST HACKBERRY (Cameron Ph.)	Stanolind Oil & Gas Co.	Mary Duhon #8	3/14/38	133 Bbls.	....	22.0	3,263

From Louisiana to New Zealand

"LOUISIANA'S NATURAL RESOURCES SERVE THE WORLD." This statement has been made for many years and has been substantiated by shipments of Louisiana's natural products to all parts of the world. Forest products, particularly lumber, naval stores, creosoted materials and paper, have been exported to all parts of the globe.

In 1923 the Department of Conservation, through its Division of Forestry, established the first tree seed nursery in the South. In addition, it established a private nursery in Bogalusa for the Great Southern Lumber Company, and this Company alone raised and planted over thirty million seedlings on thirty thousand acres. With the Department of conservation's tree nursery and the private nurseries under its supervision, over ninety million trees have been raised and planted in Louisiana and the adjacent States.

To successfully operate a tree nursery it is essential to obtain good seed at a fair price. This problem was met by the Division of Forestry organizing seed collectors in the various parts of Louisiana. These seed collectors are boys instructed in the proper way of collecting the seed of various species, both pine and hardwoods.

The Division of Forestry spends annually between two and three thousand dollars for the collection of tree seeds, this money being paid to the local people who gather the pine burs and hardwood seeds. The Division of Forestry has its own seed cleaning establishment at Woodworth, Louisiana, and its product is of a high standard and germinating percent. During the past fifteen years the records show that pine seeds, as well as hardwood seeds, have been shipped to Europe, Asia, South Africa and South America, as well as Australasia.

Records have been kept of the success of Louisiana tree species in these various foreign regions. Probably the most successful research and study have been accomplished by the State Forest Service of New Zealand. In the past ten years New Zealand, through its Director of Forestry, Mr. A. D. McGavock, has carried on experiments and has found that Louisiana pines do remarkably well in an area where pine trees have never been known to grow. After eight years of experimentation, in the fall of 1937 a shipment of the following pine seeds was sent to New Zealand:

6-year old Loblolly in New Zealand

100 pounds of longleaf pine seed
150 pounds of loblolly pine seed
150 pounds of slash pine seed
100 pounds of shortleaf pine seed,

at a total cost of $1,399.80. This service features the Division of Forestry's efficient nursery development.

The growing season in New Zealand is the opposite of that of the North American continent, and it is necessary to ship the seeds immediately after harvesting in the fall, so that they can reach New Zealand in fast time for their Spring planting which starts when Louisiana's winter season begins. In addition to the above seeds well known to the foresters, special shipments of **Pinus Sondereggeri** were made. **Pinus Sondereggeri** is a new species that nature has developed for the past three hundred years, the original parents being a hybrid resulting from the loblolly pine pollinating the longleaf pine. The hybrid has reproduced itself consistently to the fourth generation from the records studied in this State. To carry on further study of this species, which is found from Texas to the Atlantic Seaboard in the Southern Pine belt, the seedlings were sent to New Zealand.

Mr. McGavock reports his findings from year to year and states that on 103 Sonderegger pines checked the average height in three and one-half years from seed was ten and one-half feet, which is a very fine growing record and similar to the growing conditions in Louisiana. Loblolly pine and the longleaf pine also are growing in New Zealand at the same rate that they do in Louisiana.

The remarkable feature is that no pines had been known to grow in New Zealand prior to this experiment. Mr. McGavock is to be given credit for his research work and faith in the fact that Southern pines will grow in New Zealand. Every indication of his records show that New Zealand will be producing pine trees for lumber and forest products.

The pine seed shipment in the fall of 1937, under favorable conditions, will assure the Government of New Zealand between twelve and fifteen million seedlings, which will plant twelve to fifteen thousand acres at the rate of one thousand trees to the acre, the system recommended by the Louisiana Department of Conservation. It is interesting to note that trees, like human beings, can be transported from one section of the world to another. Trees are living things. There is no reason why the Government of New Zealand cannot have a successful commercial forest of Southern Yellow pines in a comparatively short time, 15 to 25 years.

Louisiana is proud of being associated with an experiment of this type, which is proving successful under the expert supervision of the New Zealand Director of Forestry.

Polymerization In The Petroleum Industry

By

J. B. FERCHAUD, JR.

With the advent of higher powered motor cars and airplanes, the petroleum industry is continually looking for means of improving their refinery processes in an effort to produce better motor fuels. Perhaps the first important step in this direction was the introduction of cracking, which is a process whereby gasoline is made from a gas oil or heavy distillate fraction of the crude. Cracking is simply a breaking down of these heavier stocks into gasoline by means of controlled thermal decomposition.

Production of cracked gasolines results in the formation of much gas. The more gasoline produced, the greater the quantity of gases. These gases contain from about ten to about fifty percent of olefins, unsaturated paraffinic hydrocarbons, depending upon the cracking conditions.

The well known reactivity of these olefins and the relative simplicity of composition of gaseous mixtures suggested that these gases could be used as the starting material for another refinery process. With this as a starting point the research developed the polymerization process, which consists primarily of the combination of the gaseous molecules to produce gasoline. The great advantage to the petroleum industry of the polymerization process is that it increases the yields of gasoline from crudes and natural gas and also produces gasolines of a higher octane rating.

This attempt to synthesize motor fuel from gas resulted in the development of two main types of polymerization processes. These are catalytic and thermal. Much has been previously published on each of these processes, and it is not within the scope of this article to go into details of their operation, except to say that there are many patented processes for accomplishing the same results and many different catalysts are used. It is also well to know that it was not until 1937 that polymerization received general attention commercially. Its possibilities for the utilization of refinery waste gases appear to be without limit, and estimates made of the possible production of motor fuel by this means in the United States show a figure in excess of 9,000,000,000 gallons of the product annually. The quality of the gasoline made, of course, varies with the nature of the charging stock, the intensity of temperature and pressures used, and the kind of catalyst, if one is used. However, it is sufficient to point out that a polymerized motor fuel is superior to any other motor fuel, and it usually has an octane rating ranging between 80 and 90.

Conversion of Vapors

The adoption of polymerization by the natural gasoline industry presents a newer conception of their work. The vapors contained in natural gas are converted into a finished motor fuel by this synthetic process, in contrast to the simple process of merely recovering the natural vapor contained in the gas. With this change has come a decided improvement in quality. It is obvious that a change so complete as this cannot be accomplished in a few years, but there are at least two natural gasoline plants in which the polymerization of the propane, butanes, and other constituents of natural gas are being converted into valuable motor fuel fractions of a higher and higher antiknock rating.

Thus we can see that the natural gasoline division of the petroleum industry is faced with having to revamp its operations—in certain districts at least—to adopt polymerization. The cost of this equipment is high compared to ordinary gasoline plant equipment, but, of course, the product produced is correspondingly more valuable. However, for these reasons, and also because of the difficulty encountered in segregating a sufficient quantity of the liquid charging stock to make a polymerization unit economically justifiable, it is not likely that many polymerization units will replace present natural gasoline plants.

Since the refiners may tear down or build up hydrocarbon molecules almost at will by means of the cracking and polymerization methods, it seems quite natural that they would manufacture hydrocarbons outside of the motor fuel range. Because of the large supply of oil and gas and the high prices of the finished products, this field appears, quite inviting. However, due to an inadequate market, only a small volume of such products are made, and most of this is done by established chemical companies who buy the refinery gases. Such products as alcohols, glycols, ketones, and aldehydes are made in this manner, but the present sources of supply appear adequate.

Direct Polymerization

In the processing of high grade lubricating oils, direct polymerization also plays an important part. This is demonstrated in at least two commercial applications: a. in the manufacture of an entire lubricating oil of especially high quality; b. in the manufacture of a polymer of high molecular weight which, upon blending with a lubricating oil, imparts to it a high viscosity index.

In the first case, the actual material used commercially is thought to be a special distillate obtained by cracking paraffin wax. The products produced are oils of exceptional quality, and they have a high viscosity index. Nevertheless, the cost of this process limits its field of application.

In the second process, light ends of refinery gasoline are polymerized to an optimum molecular weight, and this product is then added to some light lubricating oil. By severe tests in service, these oils have been found to give low oil consumption, low carbon and sludge forming tendencies, easy starting in cold weather, and good piston seal and lubrication. Their main advantage over oils consisting entirely of polymers is that they are cheaper.

In the manufacture of artificial asphalt, a product of great commercial importance, polymerization found a synthetic application in the petroleum industry. In this process, a heavy residuum from the distillation of crude oil is used. The operation consists of blowing the stock with air at temperatures ranging from 400° to 550° F. Catalysts may be, but are not ordinarily used. As the oxygen content of the product is not increased while the blowing process is continued to produce successively harder grades of asphalt, it is proved that the hardening process is due largely to polymerization and not oxidation.

Production of Aromatics

Another field explored on a semi-commercial basis was that of producing aromatics from petroleum gases. The importance of this field cannot be overestimated when it is realized that many countries are without gas-manufacturing plants and are without coking grades of coal, from which aromatics have been produced for about 75 years. With the continued and increasing production of petroleum and natural gas, it will profit the refiners and chemical concerns to thoroughly investigate this source of aromatics. This production of aromatics from petroleum and natural gases resolves itself into a polymerizing process. The gases used in this process are derived from both vapor-phase and liquid-phase cracking units.

The reactions of hydrocarbons in silent electrical discharges are also an example of polymerization, although many other reactions occur. Among the possibilities that these electrical reactions offer to the petroleum industry are the following:

1. The production of acetylene from natural or cracked gas.
2. The production of high octane gasoline from natural or cracked gas as well as straight run gasoline.
3. The improvement of the quality of lubricating oils.

Although at the present time only the fundamental chemistry of these reactions is known, it is felt that by a complete knowledge of the theory and mechanism of these reactions it will be possible to evaluate their potential commercial possibilities.

Electrionization

The exception to this is the commercial electrical process (Electrionization or Voltolization) for producing or reforming lubricating oils. The mechanism of this process consists essentially of subjecting the oil to an electrical discharge in an atmosphere of hydrogen. The action of the discharge causes dehydrogenation of the oil, with subsequent polymerization to form larger molecules. The net result is an increase in the viscosity of the oil.

For the treatment of pure mineral oils the reaction is usually too slow to be economically used. On the other hand, fatty oils polymerize quite rapidly. So it is customary to start with a fatty oil or a fatty oil-mineral oil blend and treat this. The product is then diluted with mineral oil until the final product contains about 15% fatty oil.

There are many advantages to be secured by this treatment, most of which can be listed as follows:

1. The viscosity is increased.
2. The pour point is lowered.
3. The viscosity-temperature coefficient is decreased.
4. The sludge forming tendency is decreased.

The only disadvantage of this treatment is that the tendency of the oil to form emulsions with water is increased.

It is not known just what mineral oils are most desirable for this treatment. It is known, though, that aromatic hydrocarbons give the lowest yields of polymer on voltolization.

In an article recently published by Ipatieff and Pines on the polymerization of ethylene in the presence of phosphoric acid as a catalyst, it was shown that the liquid polymers formed contained olefinic, paraffinic, naphthenic, and aromatic hydrocarbons. This type of polymerization, where different types of hydrocarbons are formed, has been named conjunct polymerization.

Komarewsky and Balai, using the above knowledge as a starting point, showed that they could direct this conjunct polymerization so as to increase the amount of aromatics, and thus produce a polymer with better motor qualities. This was accomplished by the use of a mixed polymerizing and dehydrogenating catalyst.

The advantages of polymerization to the petroleum industry are both economical and conservational. This commercial application of polymerization has not only meant the increased production of aromatics or gasoline of high-octane blending qualities and reduced the waste of volatile gases, but has done much toward removing the natural limitations of charging stocks. Crude oils having limitations of quantity, or quality of gasoline may often be converted into satisfactory charging stock by inclusion of selective cracking and polymerization units in the refinery equipment.

REFERENCES

1. The Oil and Gas Journal, vol. 36, No. 33, Dec. 30, 1937.
2. The Oil and Gas Journal, vol. 36, No. 46, March 31, 1938.
3. The Petroleum Engineer, vol. 9, No. 2, Nov., 1937.
4. The Reactions of Hydrocarbons in Electrical Discharges, by Charles L. Thomas, Gustav Egloff, and J. C. Morrell.
5. Polymerization and Its Applications in the Fields of Rubber, Synthetic Resins, and Petroleum, by Burk, Thompson, Weith, and Williams.

EDITORIAL

"The Bird Life of Louisiana"

Entitled "The Bird Life of Louisiana", a new and highly important bird book will shortly be published by the Department of Conservation. No book previously published concerning the bird life of this State approaches the new volume in thoroughness, interest and scientific and popular value. It will be indispensable for every teacher, amateur ornithologist and student of the out-of-doors.

A book of some 850 pages, "The Bird Life of Louisiana" is attractively printed, is illustrated with eight colored plates and some forty-odd black and white plates, and carries a strikingly designed cover. The cover design makes use of the Ivory-billed Woodpecker, one of the rarest North American birds, a species under the especial protection of the Department of Conservation.

Prepared by Dr. Harry Church Oberholser, Senior Ornithologist of the Bureau of Biological Survey, "The Bird Life of Louisiana" represents many years of scientific study of Louisiana birds, and presents also a vast volume of new information concerning the birds of the State. "The Bird Life of Louisiana" adds more than two score new species and subspecies of birds never before included in the list of the birds recorded for the State. The researches that made these invaluable additions possible were in part the cause of the delay in the publication of this book. Furthermore, Dr. Oberholser in this volume describes for the first time a number of new subspecies of birds hitherto undetected by scientists.

This bulletin will shortly be followed by a second bird bulletin, supplementary to it, prepared by James Nelson Gowanloch, Chief Biologist of the Department of Conservation. Together, the two publications will form a compact and relatively complete reference source for all teachers, bird students, nature lovers, hunters and lovers of the out-of-doors who are interested to any degree whatever in the study of birds. Announcement of the publication of the second bird book will be made when it is issued.

"The Bird Life of Louisiana" gives for each species and subspecies that occurs in the State a brief and interesting summary of the habits of the bird and a very complete account of the known distribution and known breeding records of the particular species in Louisiana. This last feature is of highest scientific importance since such data has never before been included in such valuable detail in any previous general discussion of the birds of the State.

The publication by the Department of Conservation of this new bird book will be hailed with pleasure and gratitude by scientist and amateur alike.

Underground Water Resources

In this issue of the Conservation Review we publish a thorough discussion of certain legal aspects of the ownership of underground water resources. The article deals largely with areas in the United States where there is a very limited water supply, or areas highly populated and industrialized where there are large quantities of underground water taken from the ground.

The subject is of special interest at this time, since the Department of Conservation has recommended enactment of legislation to facilitate a study of the surface and underground resources of the State of Louisiana.

The Department has entered into an agreement with the United States Geological Survey to investigate the underground water resources of Louisiana. The plan is to conduct underground water investigations until the entire state is covered; the areas to be investigated first are those in which underground water problems are pressing for immediate solution.

It is not the intention of the Department to make strict and rigid rules regarding the use of underground waters. It is our purpose to first make a thorough study of the underground waters of Louisiana with the purpose of conserving the underground waters in those areas in which there is an inadequate supply and immediate danger of depletion.

In certain areas of Louisiana it is probable that the recharge of underground reservoirs may be greater than the quantity of water taken out by wells. The point I wish to emphasize is that by the enactment of legislation at this time, we will be able to make a thorough study of our underground waters with the purpose of conserving these waters in areas where their wasteful use would be detrimental to the public interest.

Vol. VII SPRING, 1938 No. 1

Published Quarterly
by the
Department of Conservation
New Orleans, La.

WILLIAM G. RANKIN
Commissioner

JAMES P. GUILLOT
Secretary

DR. J. A. SHAW
Director, Division of Mines and Minerals

V. H. SONDEREGGER
Director, Division of Forestry

ARMAND P. DASPIT
Director, Division of Fur and Wild Life

J. B. DAUENHAUER, JR.
Director, Division of Enforcement and Fisheries

JAMES N. McCONNELL
Director, Division of Oysters and Water Bottoms

JAMES N. GOWANLOCH
Chief Biologist
Bureau of Scientific Research and Statistics

MRS. ESTELLE V. COTTMAN
Acting Director, Bureau of Education

CYRIL K. MORESI
State Geologist

PHILIP A. GEHLBACH
Superintendent of Department's Flotilla

HENRY A. CASSOU
Auditor

JAMES P. GUILLOT
Editor

JAMES N. GOWANLOCH
Associate Editor

WILL BRANAN
Managing Editor

Announcing

The Bird Life of Louisiana

Department of Conservation Bulletin No. 28

Edited by Dr. Harry Church Oberholser
Senior Ornithologist of the United States Government

Over 800 pages, profusely illustrated. Eight plates in full color.

The study of birds offers one of the most interesting and instructive approaches to the whole field of natural history. Birds form a relatively small and compact group so that it is possible for a reasonably studious and industrious amateur to master a knowledge of practically all the birds of any one North American locality. Other characteristics of birds, their often bright and sharply patterned plumages, their varied and interesting calls and songs, their wide range of nesting habits, all likewise afford additional appeal for the nature lover and for all who are fond of the out-of-doors.

This volume by Dr. Oberholser will shortly be followed by a second volume, Bulletin No. 29, prepared by James Nelson Gowanloch, Chief Biologist of the Department of Conservation, who will present in compact form additional information necessary to teachers and to bird students who may not have access to the many and various general publications on ornithology.

A nominal charge of $1.00 will be made for each of these bulletins to cover the expense of handling and mailing.

DEPARTMENT OF CONSERVATION
126 Civil Courts Building
New Orleans, - - Louisiana

Library
Louisiana State University

The year 1849 has gone down in history as the year of the wild stampede to California, with the gold in "them thar hills" to lure the "rich man, poor man, beggar man"—adventurers all.

To-day the scene shifts to Louisiana. It is no longer yellow gold, but liquid black gold. No longer is it Lady Luck, but the enterprise and engineering skill of large organizations with the patience and capital to "carry on."

It is adventure, nevertheless. It is the thrill of pursuit, of achievement. It is very exciting.

And this Department takes no little pride in the swift expansion of the oil industry in Louisiana. Through the surveys and special bulletins of our geologists we have pointed the way and stimulated the interest of operators in all sections of the state.

Louisiana has pioneered in deep drilling in her marshlands and coastal waters; the exploration and discoveries of the past two years will lead to the most intensive development in the history of the oil industry.

The production of crude oil has doubled since 1935, the value of this product at the source being $114,702,187 for the year 1937. With natural gas, natural gasoline and carbon black, Louisiana's revenue from the oil industry totalled $132,499,193.79 for 1937.

Here is the magic "black gold" that will generate the power of our new industrial empire—fatten our factory payrolls, pave our highways, extend our educational facilities, add to the buying power and prosperity of our people.

DEPARTMENT OF CONSERVATION

126 Civil Courts Bldg.
New Orleans, - - Louisiana